ILLUSTRATIONS

OF

INDIAN BOTANY;

OR

FIGURES ILLUSTRATIVE OF EACH

OF THE

NATURAL ORDERS OF INDIAN PLANTS,

DESCRIBED IN THE AUTHOR'S

PRODROMUS FLORÆ PENINSULÆ INDIÆ ORIENTALIS;

WITH OBSERVATIONS ON THEIR BOTANICAL RELATIONS, ECONOMICAL USES, AND MEDICINAL PROPERTIES; INCLUDING DESCRIPTIONS OF RECENTLY DISCOVERED OR IMPERFECTLY KNOWN PLANTS.

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SURGEON OF THE MADRAS ESTABLISHMENT.

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ILLUSTRATIONS

OF

INDIAN BOTANY.

LXIII.—ALANGIEÆ.

A small order of Indian shrubs but whose place in the series of orders seems still uncertain. DeCandolle who established the order on the single genus *Alangium,* but afterwards added *Marlea,* placed it between *Melastomaceae* and *Philadelpheae* near *Myrtaceae,* which arrangement we adopted. Bartling, however, does not approve of this station, but does not propose any other, merely placing it for the present along with several other orders, the places of which are in his opinion equally uncertain, at the end of his arrangement. Lindley refers it to his alliance *Myrtales* in his polypetalous epigynous group, thus associating it with nearly the same orders that DeCandolle does, but places it between *Combretaceae* and *Rhizophoreae* in place of between *Melastomaceae* and *Myrtaceae.* Meisner, the latest writer on the subject, thinks it approaches more nearly to *Corneae* than to *Combretaceae* and accordingly refers it to Jussieu's class *Epipetalae* Of these several proposals the last seems the nearest correct, since they more nearly associate in the character of their ovary, fruit and albumenous seed, with *Cornus* and *Loranthus,* than with either *Combretum* or *Myrtus,* but with which it is desirable they should remain associated on account of their numerous petals, that being the character of the group in which they are arranged.

The order consists of deciduous shrubs or small trees, with alternate, exstipulate, glabrous, entire leaves without pellucid dots, much resembling those of some species of Grewia, with axillary congested largish white flowers and eatable fruit.

" Calyx campanulate, 5-10 toothed. Petals as many as the segments of the calyx, linear, reflexed : æstivation twisted. Stamens long, exserted, once, twice, or four times as many as the petals : filaments distinct : anthers introrse, two-celled, often sterile. Ovarium globose, cohering with the tube of the calyx ; 1-2 celled : ovules solitary, pendulous : style 1, subulate, expanded at the base into a thick coloured fleshy disk covering the top of the ovary : stigma dilated Berry (balausta) oval, cohering with the tube of the calyx, and somewhat crowned by its limb, fleshy, slightly ribbed, 1-2 celled : endocarp sometimes osseous, and separating from the sarcocarp like a putamen Seeds solitary, pendulous. Albumen fleshy. Embryo straight : radicle superior : cotyledons flat, foliaceous. Trees. Leaves alternate, exstipulate, entire, not dotted. Flowers few, axillary, fascicled, shortly peduncled."

Affinities. These as will appear from the preceding remarks are still undetermined; their epigynous flowers and numerous petals and stamens associating them with *Myrtaceae*, while their few celled ovary with solitary, pendulous ovules and albumenous seed, seem more justly to refer them to the vicinity of *Corneae* and *Caprifoliaceae* (where Meisner has placed them) two nearly allied orders.—Upon the whole, I think we may conclude, that the true relations of this order are still unknown but that it is conveniently, if not correctly, placed in its present situation.

Geographical Distribution. All the species of this small order, 3 in number, yet known, are of Indian origin—two species of *Alangium* are natives of the Peninsula and both found in the Carnatic. DeCandolle and Lamark have added a third which however does not seem distinct from *A. decapetalum.* The genus *Marlea* referred here by DeCandolle has yet only been found on the Himalayas and in China.

Properties and Uses. Little seems known on this head: the two species of *Alangium* are said to be cathartic, and the roots aromatic. Dr. Royle remarks " they are said to afford good wood and edible fruit." The first of these, at least in one sense, I am inclined to doubt as I have never seen the plant larger than a rather large shrub so that whatever the quality of the wood, it must always, I presume, be small. Roxburgh says it is beautiful. The fruit however are edible but not palatable being mucelagenous and insipid.

EXPLANATION OF PLATE 96.

1. Alangium hexapetalum, flowering branch—*natural size.*
2. Dissected flower, showing the calyx ovary, a petal, stamen, style and stigma.
3. A stamen detached.
4. Ovary cut vertically, showing the solitary pendulous ovule.
5. Ovary cut transversely, one-celled—*all more or less magnified.*

LXIV.—GRANATEÆ.

The most eminent Botanists of the present day are divided in opinion as to the propriety of considering this a distinct order, or merely a section of *Myrtaceæ.* Don, DeCandolle, and Martius, view it as a distinct order. Lindley, Arnott and Meisner, take the opposite side of the question. At the time of preparing the accompanying plate and long after, when writing my account of *Myrtaceæ,* I also adopted the latter view—circumstances having occurred to delay the publication of that article I have been enabled to reconsider the subject and review afresh the arguments on both sides, carefully examining the structure of the ovary and fruit as I went along. The result has led to the conviction that this is really a distinct order. I should scarcely I think have come to this conclusion had I not previously ascertained the possibility of carpels having their position reversed in the ovary, because until I did ascertain this, I could not understand or explain, to my own satisfaction, the appearances which sections of this ovary presents and preferred remaining silent to giving an opinion which I felt myself unable to support. Having at length been enabled to make up my own mind on the subject, I shall here explain my views and contrast them with those of my predecessors who have written on the subject. As the main object of the strictly Botanical portion of this work is to explain the principles of the science, I trust I shall be excused for considering somewhat at large a question on which the sentiments of so many eminent Botanists are divided. I regret being unable to quote professor Endlicher's opinion, not having yet received the part of his genera Plantarum containing this order. The following extracts will place before the reader both sides of the question which wholly rests on the views each author takes of the structure of the fruit. Don, the original proposer of the order, and DeCandolle describe it thus.

" Ovary cohering to the tube of the calyx free at the apex many celled. Berry apple-shaped crowned with the contracted limb of the calyx; rind thick, covered exteriorly with a redish smooth cuticle with shining points, spongy within; the berry when ripe bursting irregularly. Placenta resembling the substance of the rind but more fleshy and succulent, completely

Rungiah del *Winchester Lith*

ALANGIUM HEXAPETALUM (Lam)

அழிஞ்சிமரம
Alingemarum } Tam

filling the berry, excavated into numerous unequal many-seeded cells. No true partitions, but spurious ones, arising from the substance of the placenta, of variable thickness and very fragile"* or as explained by himself in English " a fleshy receptacle formed by the tube of the calyx into a unilocular berry filled with a spongy placenta, which is hollowed out into a number of irregular cells in which the seeds are placed, the dissepiments being nothing more than thin portions of the placenta. *Don. Edin. New Phl. Jour.* 1826.

" Fruit large, spherical, crowned by the limb of the calyx, indehiscent; the fruit is the tube of the calyx divided horizontally into two chambers or parts, the upper division 5-9 celled, the lower division 3 celled; the dissepiments membranous separating the cells; the placentas of the upper part of the fruit fleshy, reaching from the parietes to the centre; those of the lower divisions progressing irregularly from the bottom of the fruit." D.C. prod.—Pg. 3.

On the opposite side Lindley examines the question at great length and is followed by Arnott, who gives a more brief but I think better exposition of the argument on this side than his leader. I subjoin both in full.

" The fruit of the Pomegranate is described by Gærtner and DeCandolle as being divided into two unequal divisions by a horizontal diaphragm, the upper half of which consists of from 5 to 9 cells, and the lower of 3; the cells of both being separated by membranous dissepiments; the placentæ of the upper half proceeding from the back to the centre, and of the lower irregularly from their bottom; and by Mr. Don as a fleshy receptacle formed by the tube of the calyx into a unilocular berry, filled with a spongy placenta, which is hollowed out into a number of irregular cells. In fact, if a Pomegranate is examined, it will be found to agree more or less perfectly with both these descriptions. But it is clear that a fruit as thus described, is at variance with all the known laws upon which compound fruits are formed. Nothing, however, is more common than that the primitive construction of fruits is obscured by the additions, or suppressions, or alterations, which its parts undergo during their progress to maturity. Hence it is always desirable to obtain a clear idea of the structure of the ovarium of all fruits which do not obviously agree with the ordinary laws of carpological composition. Now, a section of the ovarium of the Pomegranate in various directions, if made about the time of the expansion of the flowers before impregnation takes place, shews that it is in fact composed of two rows of carpella, of which three or four surround the axis, and are placed in the bottom of the tube of the calyx, and a number, varying from five to ten, surround these, and adhere to the upper part of the tube of the calyx. The placenta of these carpella contract an irregular kind of adhesion with the back and front of their cells, and thus give the position ultimately acquired by the seeds that anomalous appearance which it assumes in the ripe fruit. If this view of the structure of the Pomegranate be correct, its peculiarity consists in this, that, in an order the carpella of which occupy but a single row around the axis, it possesses carpella in two rows, the one placed above the other, in consequence of the contraction of the tube of the calyx, from which they arise. Now, there are many instances of a similar anomaly among genera of the same order, and they exist even among species of the same genus. Examples of the latter are, *Nicotiana multivalvis* and *Nolana paradoxa*, and of the former *Malope* among *Malvaceae;* polycarpous *Ranunculaceae* as compared with *Nigella*, and polycarpous *Rosaceae* as compared with *Spiraea*. In *Prunus* I have seen a monstrous flower producing a number of carpella around the central one, and also in consequence of the situation, upon the calyx above it; and, finally, in the *Revue Encyclopédique* (43-762), a permanent variety of the apple is described, which is exactly to *Pomaceae* what *Punica* is to *Myrtaceae*. This plant has regularly 14 styles and 14 cells, arranged in two horizontal parallel planes, namely, 5 in the middle, and 9 on the outside, smaller and nearer the top; a circumstance which is evidently to be explained by the presence of an outer series of carpella, and not upon

"* *Ovarium* tubo calycis accretum, apice liberum, multiloculare * * * *Bacca* pomiformis, limbo tubuloso dentato calycino, nunc contracto, coronata: *cortex* crassissimus, extus cuticula lævi rubicunda punctata lucida vestitus, intus spongioso-carnosus, albus, dein, matura bacca, fissura irregulariter rumpens—*Placenta* cortici baccæ substantia simillima, at magis carnosa et succulenta, baccam omnino replens, in loculis numerosis polyspermis inæqualibus reticulatim atque interrupte excavata. *Dissepimenta vera* nulla: *spuria* tamen adsunt, quæ e substantia placentæ orta, valde sunt fragilia, et crassitie varia." (Don. l. c.)

the extravagant hypothesis of M. Fillette de Clermont, who fancies that it is due to the cohesion of 3 flowers."—*Lindley's Natural System of Botany.*

" This genus only differs from the other *Myrtaceae* by having two verticels of carpels developed instead of one, and perhaps in a truly wild state the upper or adventitious one may occasionally disappear. The inner series (or those at the bottom of the fruit) have their placentæ in the axis ; but the outer series, forced to the top of the fruit by the contraction of the mouth of the tube of the calyx, having their placentæ in the ovary at the back of the inner carpels, exhibit them in the ripe fruit in a horizontal position on the upper surface of the lower cells."—*Arnott Encyclop. Brit. Ed. 7, et Prod. Fl. peninsula* 1 *Pg.* 327.

Premising that the whole controversy turns on these questions, 1st, what is the true structure of a Pomegranate? and 2d, whether the difference between it and *Myrtus* is sufficient to separate these genera as types of distinct orders?

I shall now proceed to examine these conflicting statements and endeavour to ascertain on which side the balance preponderates and whether indeed, there is not room for an explanation different from any of these yet proposed.

Mr. Don's description of this fruit on the strength of which he first proposed to remove this genus from *Myrtaceae*, the order with which it was previously associated, as a distinct family appears to me most unphilosophical and altogether untenable. He, as I understand, considers the fruit a one-celled receptacle the centre of which is filled with a spongy placenta, round the surface of which there are a number of irregular cells occupied by clusters of ovules: but he does not tell us how the central placenta got there neither does he account for the ovules being attached to the parietes of the cell and not to the central placentæ.

His whole description in fact proves that it had been drawn up from inadequate examination and that he, at the very time he is accusing all authors of overlooking the real structure of this fruit, totally misapprehends it himself, as we shall by and by see.

DeCandolle gives a more correct description of it when he says that it consists of two chambers, the under 3-celled, the upper from 5 to 9-celled, with the placentas of the upper cells reaching from the parietes to the centre while those of the lower division proceed irregularly from the bottom of the fruit. He does not however assign this peculiar structure as his principal reason for viewing the order as distinct from *Myrtaceae*, but has recourse to others in my estimation of minor importance.

Lindley conceives that there are two rows of carpels, three or four of which surround the axis at the bottom, while the remainder surround these and occupying the upper part of the fruit adhere to that part of the tube of the calyx. The placentas of these upper carpels he conceives contract an irregular kind of adhesion with the back and front of their cells. The meaning of this is far from being clear to me, but if it means that he considers the placentas of the upper as well as the lower row to proceed from the axis towards the circumference to which last they contract accidental adhesions, then he takes an erroneous view and if the examples quoted in illustration support this view, they are not in point as regards the structure of *Punica.*

Mr. Arnott like Lindley views the fruit as consisting of two rows of carpels, an outer and inner, the former of which he thinks may be adventitious. To understand his theory we must first suppose the tube of the calyx spread out as a flat surface and covered with two circles of carpels, the inner next the axis and the outer occupying a larger circle beyond. That the margin of the calyx then contracts so as to turn the outer series over the inner. According to this supposition, the attachment or base of the placentas of the outer series should be in the circumference and the apex in the centre, while that of the inner should be in the opposite direction, that is, have the base in the centre and the apex towards the circumference, an explanation which is in accordance with what we find, except in so far as it does not account for the horizontal partition between the two series, nor can I exactly understand on what ground we are warranted in assuming that the outer series is adventitious and the result of cultivation, as it has every where been found so constant in all circumstances. But be that as it may, this theory certainly accounts for the crossing of the placentas in the two rows, which we so invariably find, whether correctly or not cannot be determined until we get fruit with a single row of carpels, which has not yet been found.

These explanations, which I venture to propose, of rather obscure descriptions did not occur to myself until after I had formed a new theory of my own, the result of a very careful examination of the ovary in all its stages from the earliest, up to the period of impregnation. At these early stages when the whole flower has not yet attained half an inch in length probably a fortnight or more before expansion I invariably find two rows of carpels, one inferior, of 4 or 5 and one superior of 5-6 or more. In the lower series the placentas are ranged round the axis with their base in the centre and the apex, which is free, towards the circumference. In the upper the attachment, or base of the placentas, is in the circumference and the apex, also at first free, directed towards the centre. Between the two rows a diaphragm is always interposed. The apex of the upper placentas is occasionally, afterwards, prolonged and contracts adhesions to the axis.

In the accompanying figures I have attempted to represent these views. As the fruit advances in size considerable derangement of this structure progressively occurs which is apt to mask and confuse the appearances now described.

Having previously ascertained the occasional existence of inversion in the position of carpels, my first idea was that such an inversion took place in the upper row. This view, which, equally with the preceding, accounts for the crossing of the placentas I feel inclined to adhere to, though I confess not without some hesitation, because it implies a complexity of arrangement rarely met with in the inimitably simple and beautiful operations of nature, but I think it as difficult to imagine the nearly equally complex and inconceivable operation of the folding in of one set of carpels over the other, which the explanation of Drs. Lindley and Arnott demand, while my explanation has the advantage of at the same time accounting for the double chamber which the ovary presents from its earliest stages, and renders unnecessary the doctrine of an adventitious verticel of carpels which for the present is mere assumption.

With these explanations I leave the question of structure to consider the one pending on its determination, viz. whether or not *Granteae* ought to be preserved as a distinct order or be reunited to *Myrtaceae*?

On this point so far as the unvarying evidence derived from cultivated plants is entitled to carry weight on a disputed point—and which I presume it must do until we find that evidence invalidated by the examination of others growing in a truly wild state—we must unquestionably, I conceive, adopt the views of those who urge the separation, because, the complex structure, above described, being constant here and unknown among true *Myrtaceae,* we have no right, in the total absence of direct confirmatory evidence, to assume that a part is adventitious, merely because it is at variance with our ideas of what should be, especially while we have in addition, differences in habit, in the formation of the seed (the cotyledons are foliaceous and spirally convolute) and in their pulpy envelope still further to confirm the correctness of these views.

In coming to this conclusion I do so mainly on the evidence I have myself adduced, attaching no value to the opinion of Mr. Don, which, being founded, according to his own showing, on most erroneous views of the structure of the fruit does not merit much consideration.

To the views of DeCandolle more importance must necessarily be attached, as the reasons he assigns are more satisfactory, though I do not think he has awarded sufficient value to the very peculiar "economy of the fruit" while he has laid too much stress on others of much less note, such as the want of pellucid dots, the absence of the marginal nerve of the leaves and the pulpy covering of the seed ; thereby, throwing into the shade the true essential character of the order, which unquestionably is the double row of carpels, with the upper placentas parietal and crossing the lower axillary ones, which, if I have rightly accounted for, constitute this a truly curious and unique fruit.

Affinities. According to the explanation now given, the affinities of this order remain to be determined, no known order presenting a similar combination of structure. But adopting the arrangement of Jussieu and DeCandolle, the one followed with some slight modifications in this work, we can scarcely find a more appropriate station for it than the one it now occupies, though but remotely allied to the orders among which it is placed.

Geographical Distribution. Found widely distributed over Asia but every where cultivated. Arabia is however supposed to be its native country.

Medical Properties. For these see *Myrtaceae* the order under which I at first included this genus.

EXPLANATION OF PLATE 97.

1. Punica granatum, flowering branch—*natural size.*
2. Flower and ovary cut vertically.
3. Ovary cut transversely, section near the apex of the ovary; apparently the section seen and described by Don.
4. Stamens.
5. A young fruit cut transversely, showing the parietal attachment of the upper row of carpels.
6. A seed covered with pulp.
7. The same cut transversely.
8. The same more highly magnified, showing the spirally convolute cotyledons.
9. A longitudinal section of the seed showing the embryo *in situ.*
10. Cotyledons unrolled—*all more or less magnified.*

For further dissections of the ovary of this plant see plate 97.*

LXV.—MYRTACEÆ.

This is a large and very natural order, especially as now limited by the exclusion of the albuminous seeded genera, which Lindley, in the last edition of his natural system. has kept distinct under the names of *Barringtonieae* Lind., *Lecythedeæ* Richard, and *Philadelpheae* Don. To this arrangement Meisner objects, and recombines the whole under his order *Myrtineae*, forming tribes of those groups which others have thought ought to be considered distinct orders. With the limited means I possess for examining this question, it would ill become me to attempt to set myself up as umpire between such accomplished Botanists, but, I will so far depart from the arrangement already adopted in our Prodromous, as to follow Lindley in viewing the section *Barringtoneae* as at least a suborder, on account of its very remarkable seed and general habit, which appears to distinguish it sufficiently from the rest of the order.

I have at different times befere expressed doubts of the propriety of attaching so much importance to the absence or presence of albumen, until we have attained such an acquaintance with its functions in the vegetable economy as might enable us to assign a uniform value to characters taken from it, and would not therefore now insist on its being pressed into service unless supported by other characters. On these grounds, I should hesitate to separate *Philadelpheae* the habit of which sufficiently accords with true *Myrtaceae*, simply because of their albuminous seed and leaves without dots, but as they besides differ in the æstivation of the corolla, in having distinct styles, and serrated leaves, all of which are absent in true *Myrtaceae*, there certainly seems much reason on the side of those who propose their separation, at the same time, it is quite undeniable, that the present fashion in Botany seems to run too strongly in that direction and that we are but too apt on barely sufficient grounds to divide families that might better be kept together, which, as in some other instances, may perhaps be the case here.

The order for the most part consists of trees or shrubs with opposite leaves, perforated with pellucid dots and abounding in fragrant resinous oil. The inflorescence is very variable, often axillary, and sessile occasionally, as in Syzygium, forming large corymbose cymes. The flowers are usually either white or red, seldom yellow and never blue.

" Calyx 4-5-6-8-cleft, the limb sometimes cohering in two portions, sometimes in one and then falling off like a cap or lid. Petals perigynous, as many as the segments of the calyx and alternating with them, sometimes slightly united at the very base; rarely wanting: æstivation imbricated. Stamens inserted with the petals, rarely as few, sometimes twice as many, usually indefinite : filaments either all distinct or monadelphous or variously polyadelphous, in æstivation curved inwards: anthers ovate, bilocular, small, bursting longitudinally. Ovarium cohering with the tube of the calyx, formed of two or more carpels, the dissepiments rarely imperfect, and hence 1-to 15-celled : style and stigma simple. Placentæ in the axis or rarely parietal. Fruit dry or fleshy, dehiscent, or indehiscent, 2-6-or many celled, or by the obliteration of the dissepiments 1-celled. Seeds rarely solitary or few, usually indefinite. Albumen none. Embryo straight or curved : radicle next the hilum : cotyledons distinct, or sometimes

மாதளமரம. } *Mathalamarum* }

PUNICA GRANATUM (LINN:)

దాళింమ్మచెట్టు } *Thalimmachettoo* }

consolidated into one mass with the radicle.—Trees or shrubs. Leaves usually opposite, entire, and with transparent dots, sometimes alternate, rarely serrated, and rarely without dots."

Affinities. These are not easily defined, for, though the order is upon the whole a very natural one and easily recognized, yet, owing to the great variety of structure which its different sections present it is not easy, in many cases, to mark their true limits. With *Pomaceae* it is allied through *Nelitris*, a genus having a 5-10-celled ovary with a single ovule in each cell. With *Lythrareae, Onagrariae, Combretaceae, Memecyleae*, and *Melastomaceae*, affinities have also been traced, but these do not seem so liable to be mistaken. DeCandolle remarks that it is an order easily divided, but he prefers keeping it united. It differs from *Rosaceae* in the adherent calyx, the united carpels and solitary style ; and from all by its exstipulate leaves : from *Lythrarieae* by the calyx cohering with the ovary. From *Combretaceae* by its many-celled ovary and erect or horizontal not pendulous ovules and the cotyledons of the embryo not convolute, but approaches through *Myrtus spectabilis* which has a one-celled ovary, and *Eugenea arcis* and *Pimenta* which have pendulous ovules : from *Melastomaceae* by its filaments neither acutely bent nor the anthers received into cavities under the divisions of the calyx and the form of the anthers : from *Memcyleae* by its many-celled ovary with superpased ovules, not one-celled with a single row of ovules surrounding the base of the style : from *Onagrarieae* by its indefinite stamens. Lastly *Myrtaceae* differ from all their allies in the pellucid dots of their leaves, in habit, and in their properties. From this enumeration I agree with DeCandolle in excluding *Granateae*, though considered so nearly related that many Botanists reunite it with this order : *Philadelpheae* originally referred here by Jussieu and retained by Meisner, is also separated as a distinct order by DeCandolle, although, under the circumstances mentioned, it must be very nearly allied. The former, as already shown, is justly excluded from the family, and the latter differs in its leaves not having transparent dots, in having twisted æstivation, several styles and albuminous seed : the first of these, absence of pellucid dots is certainly not a good distinction, since many species of genuine *Myrtaceae* want them, but the others are generally believed to supply valuable ordinal distinctions.

The order is divided into 5 sections, three of which are found in India : namely, *Leptospermeae* with a many-celled capsule and opposite or alternate leaves, which are usually dotted—*Myrteae* having a berry, distinct stamens, and opposite leaves which are usually, not always dotted : and *Barringtoneae* separated if not as an order certainly as a good suborder by having a fleshy one-celled fruit, albuminous seed, monadelphous stamens, and alternate not dotted leaves.

The order still requires investigation as it certainly includes some anomalous forms, which may perhaps find more suitable stations in other orders.

Geographical Distribution. The geographical range of this order is very extended, but principally confined to the warmer latitudes. In India species extend from the most southern part of Ceylon northward to the Himalayas and from Malabar eastward through all the intermediate countries to China. The genera best known in Coromandel, as being most generally met with are *Syzygium* and *Eugenia*, but besides these we have the Guava (*Psidium*) generally cultivated ; the Myrtle (*Myrtus*) partly cultivated and partly a native of the higher hills ; the Rose apple (*Jambosa*) usually cultivated but also a native, and in Malabar *Sonneratia*. This last and some others which I have not yet seen on the Eastern coast, render it probable many more will be found when the western jungles have been better explored. To the Eastward, several other genera are found, among which may be mentioned *Melaleuca*, *Caryophyllus* (the clove tree) *Nelitris* and a new genus *Monoxera*, R. W. In new Holland they are numerous. In Africa a good many are found especially in Madagascar, and some even extend as far south as the Cape of Good Hope where three species are described. Tropical America may however be considered their principal station, as there, they are very numerous both as regards genera and species : one only is found in Europe, the *Myrtus communis*, or common Myrtle, now to be met with in almost every garden in Madras, a fact worthy of attention, as going far to prove that arboreous plants of the south of Europe may become aclimated in even the South of India. The Clove and Pimenta or Allspice trees, have also been introduced into the Courtallum gardens,

and Ceylon. Of the latter, or perhaps it is *Eugenia acris*, there is one tree in the Government gardens in Madras, but remains unproductive though apparently healthy.

Properties and Uses. These are various. Most of the species abound in a fragrant resinous oil as indicated by the pellucid dots of the leaves and other parts. The *Cajaputi oil* so highly esteemed on account of its medicinal properties is the produce of the *Melaleuca leucadendron*, a plant of this order, a native of the Eastern islands but now common in India, and which, from its great beauty, would certainly become much more so if more easily propagated: its general aspect, when not in flower, reminds one of a weeping willow. The Rose apple and Jambo Malac are admired not less on account of the beauty of the trees, than for their fine flowers and curiously fragrant fruit which I once heard a child very characteristically describe as a fruit that "tasted like the smell of roses." The clove so well known on account of its pungent aromatic properties is also a member of this order. In addition to their aromatic qualities astringency is also a prominent feature in their constitution and is strongly developed in the bark of the common *navel* tree *Syzygium Jambolanum* as also in the fruit which have a sweetish astringent taste: this fruit, which is about the size of a cherry and of a deep purple colour, is during the season exposed for sale in the bazars in great quantities. The tree itself, which is common all over the country, attains a great size and yields a fine hard close grained timber: besides this many other trees of the order are very astringent and, according to Ainslie, the kino, met with in the Indian bazars, is the produce of *Eucalyptus resinifera* a New Holland plant.

In its medicinal properties the most remarkable plant of the order is the Pomegranate, a decoction of the bark of the root of which has been ascertained to be almost a specific in the cure of tape worm and is probably equally powerful in the removal of most other intestinal worms. The flowers and rind of the fruit are tonic and astringent and, as well as a decoction of the bark of the root, are prescribed in dysenteric complaints and other affections of the bowels. The medicinal properties of *Myrtaceae* may now be summed up in few words, aromatic and tonic combined with astringency fitting them, when different species are combined, for the alleviation of chronic bowel complaints and generally for the removal of diseases of debility.

As ornamental shrubs several species of *Eugenia* merit an equally prominent place in the garden with the common Myrtle and the timber of some of the larger trees is considered excellent, on account of its hardness, combined with close grain and great durability.

Remarks on Genera and Species. In an order so large and generally so natural, it is difficult to find characters by which to define the limits of either genera or species, without having recourse to distinctive marks to which in most other orders only a secondary value would be attached, but which in this owing to their somewhat greater constancy admitting of their being so employed, become of considerable importance—though still insufficient to give good characters or form well defind genera.

Of the tribe *Leptospermeae* we have only one genus (*Melaleuca*) belonging to it in this part of India and that not a native. It is at once distinguished by its pentadelphous stamens—and very minute seed almost like powder.

The tribe *Myrteae*, the largest of the order, is that which principally prevails in India, and requires much consideration if not indeed a complete revision of its genera before they can be said to stand on a firm foundation. As they are now defined many of them are nearly useless, the differences existing more in words than in nature. This remark is confined to the species found in India, those from other quarters being nearly unknown to me except by verbal characters. The genus *Myrtus* is said to have a many-seeded 2 or 3-celled berry, but no notice is taken of the ovary, a strange oversight, since there we generally find stable characters, not so in the mature fruit, which may be, and usually is, greatly changed in its progress towards maturity. I have examined the ovary of four reputed species. In *Myrtus communis* it is 3-celled with several ovules in each. In *M. tomentosa* it is 3-celled, each imperfectly divided by a spurious dissepiment, and containing very numerous superposed ovules attached to a central placenta. In *M. spectabilis* (?) it is one-celled with two parietal placentas, showing clearly, that it cannot well be retained in the genus of which *M. communis* is the type; and from which I have accordingly removed it: and lastly, *M. capensis* (Harvey) which must also be excluded, its ovary

partaking more of the character of *Memecylon* than of *Myrtus*. Turning next to *Eugenia*, which in its more obvious characters, those namely taken from the calyx and flower, does not differ materially from *Myrtus* but is separated by its 2-celled ovary and very different seed. These, which in *Myrtus*, are compressed reniform enclosing a terete curved embryo in a hard bony testa, are, in *Eugenia* globose, with thick soft and fleshy cotyledons; forming an excellent distinction between these often, otherwise, closely allied genera.

When we next proceed to compare *Eugenia* with its off sets, *Jambosa* and *Syzygium*, permanent distinctions are not so easily found. All three have a 2-celled ovarium with numerous ovules, all have a more or less succulent fruit, all have fleshy seed. The distinctions, therefore, attempted to be established rest on *Jambosa* having a turbinate somewhat elongated calyx tube, a grumous edible fruit and a lobed seed, in place of a globose calyx tube and conferruminate seed. The first of these can scarcely be admitted if Wallich's *E. formosa* and *E. bifaria* are to be considered genuine species, since both have the turbinate calyx and general habit of *Jambosa* and, in my opinion, are both more justly referable to that genus, as it now stands, than to *Eugenia*. The character taken from the cotyledons being lobed or conferruminate, does not appear a more satisfactory one and must, as in the instance just quoted, be received with caution, as both seem to have conferruminate cotyledons though that is not mentioned in the description. *Syzygium* is said to be distinguished from both, by the petals cohering, forming a calyptra or lid and falling off either in that state or immediately after expansion, thus making the essential character of the genus rest on its having caducous petals; the seed being the same as in *Jambosa*. This seems to me at best a very artificial character and, if not taken along with habit, is altogether nullified by several species in my collection, which have the habit of the most perfect forms of the genus, but want the deciduous petals. To establish generic characters on such distinctions, which are barely sufficient to supply very secondary sub-divisions, is altogether to banish from natural history the axiom that—the genus gives the character not the character the genus.

When we extend our comparison a step further and compare the distinctions taken from the calyx tube in these two genera *Syzygium* and *Jambosa*, we find them equally at fault. *Syzygium* is said to have the calyx tube obovate, while in *Jambosa* it is turbinate and attenuated at the base. In *S. Zeylanicum* D.C. and *S. Wightianum* Wall. it is described as elongated and clavate, while in both, the inflorescence is racemose, the flowers springing from the naked branches, as in *Jambosa malaccensis* and some others, in place of forming umbelliform cymes, the usual form in the genus, thus corresponding in habit as well as structure with *Jambosa*. For these reasons I cannot consent to separate *Syzygium* and *Jambosa*. *Eugenia* it seems to me must equally be united, if we would form a natural association.

Let us next consider *Caryophyllus*, the oldest genus of the group. It is characterized by having a cylindrical calyx tube and 4-lobed border, the petals cohering into a lid, as in *Syzygium*, and the stamens free, forming 4 tufts with a slight almost inconspicuous interval between: the inflorescence is corymbose. Here again we have the identical structure mentioned as belonging to *S. Zeylanicum* and *S. Wightianum*, with the exception of the 4-lobed limb of the calyx and 4 tufts of stamens, the fruit and seed are much the same in all—but surely the limb of the calyx being a little more or less divided can never be received as a generic character being, in truth, only fit to be employed as a specific one. For these reasons I propose to reunite these four genera *Eugenia*, *Caryophyllus*, *Jambosa* and *Syzygium* into one, and use those characters which have hitherto been employed as generic ones, for its subdivision into sections, it being quite impossible they can ever furnish good generic ones: genera which are made to depend on such characters as a greater or less development of any single organ, such as in the elongated calyx of *Caryophyllus* and of *Jambosa*, in contradistinction to the short one of *Syzygium*, or on the more or less deciduous petals of species, cannot be natural. Neither can we get good artificial genera, by the combination of these characters, unless we are prepared to multiply them beyond measure. In that case it might be easy enough to construct generic characters—for one genus might have a short calyx tube and petals that expand before falling—another might have an elongated tube and similar petals—a third might have a long tube with deciduous calyptrated petals—a fourth a short one, and so on and if rigidly adhered to, might facilitate the determination of species, but while the ovary, ovules, and fruit are nearly the same in all, the general habit the

same and the properties, only varying in degree, also the same, no one surely will deny that such genera are unworthy of science and altogether misplaced in any system professing to aspire to the character of natural.

It is surely time we were bidding adieu to such puerilities and studying, not how far we can split and multiply genera by restricting our characters within the narrowest limits, but how we may so construct them as to include every species that naturally belong to them, and to exclude all that do not, a point of perfection which, I fear, we shall not soon attain, so long as we use the varying shapes and sizes and duration of deciduous parts as generic characters and talk of natural systems, but deny that either natural orders or natural genera come from the hand of nature.

Influenced by these considerations, I reject all characters taken from the mere external form of the calyx, whether nearly truncated or lobed, long or short, also whether the petals are so caducous that they fall before expansion or fairly expand and prove as persistent as petals usually are in tropical climates, that is, have a duration of from 12 to 24 hours. Such characters applied to the distinction of genera, it appears to me, are well fitted to establish the truth of the axiom that nature does not create genera, but at the same time indicates much want of philosophy in our manner of interrogating nature and enquiring for natural genera, since such distinctions can only produce the most artificial combinations of species.

But discarding them, and looking only to structure, not to size or relative permanency of deciduous parts, we can approach more nearly to the construction of natural genera. The genus *Myrtus* might then be confined to such species as have quinary flowers, a 3-celled ovary, baccate fruit, and several bony seed enclosing a somewhat cylindrical embryo. *Myrcia* to those having quinary flowers, a 2-celled ovary, seed with a smooth not bony testa, and foliaceous corrugated cotyledons. *Jossinia* to those having quaternary flowers, a 2-celled ovary, numerous seeded fruit, like *Psidium* or *Myrtus*, and foliaceous cotyledons.

Thus defined, these appear to be all good genera, but, not having materials to compare, I can offer no decisive opinion on that point, though think it very desirable to ascertain whether a genuine *Myrtus* ever has a quaternary flower and 2-celled ovary, or a *Myrcia* a quinary flower and 3-celled ovary, for I think not : or would it not be better to class the species of these genera according to characters taken altogether from the flower and ovary, even should they occasionally be found somewhat arbitrary, because, as now defined by DeCandolle, it is impossible to distinguish a *Myrtus* from a *Myrcia* without ripe seed, which, for practical purposes, is nearly useless, we so seldom find fruit in that state in herbaria.

The genera *Caryophyllus*, *Eugenia*, *Jambosa*, *Syzygium*, and, I believe, *Acmena* D.C. all associate in having a 2-celled ovary (ever 3 ?) with numerous ovules attached to the inner angles of the cells, subdrupacious fruit, with few, generally one or two, globose fleshy seed, variously divided. By subdrupacious, I here mean a fruit consisting of an exterior pulpy or fleshy portion, sarcocarp, enclosing the seed, in this case not hard and bony, as in true drupes, but fleshy and easily sectile. The testa of the seed is besides so very thin, that unless looked for, it may be overlooked. The cotyledons or body of the seed is quite peculiar, altogether *sui generis.* In all, the radicle is small and inconspicuous with comparatively large seed lobes, these lobes being sometimes conferruminate, that is adhering by their margins so as to appear one only, at others, divided into two or three or a dozen lobes but all united in the minute central radicle.

The insufficiency of lobed or conferruminate seed to form a generic character is proved by the fact of both forms being found on the same plant. In these structural peculiarities, which pervade the whole tribe of *Eugeniae* we have, it appears to me, conclusive evidence that nature does create genera and that this group, which presents nearly every variation of vegetable form and inflorescence, being yet pervaded, through its whole extent, by a uniform structure in the organs most essential to the preservation of the species, shows that it is truly one of nature's own genera and, as such, ought on no account to be broken down and frittered away by the introduction of frivolous distinctions without practical value or facility of application when employed in practice, since in their nature they are fluctuating and unstable.

The oldest name of the group of genera, which I propose uniting into one, is *Caryophyllus*, and under that name the whole phalanx should be ranged, with the essential character—flowers quaternary, ovary 2-celled, with numerous ovules attached to a central placenta, seed thick and

fleshy, variously lobed, sometimes conferruminate, the radicle usually minute and concealed between the lobes. But, as nearly all of them have at different times been referred to *Eugenia*, even *Caryophyllus* itself, I, to prevent further confusion, retain that name for the restored genus. Adopting these characters for the genus I find that our *Eugenia acris* W. & A. and *E. Pimenta*, D.C. do not belong to it, neither are they referable to *Myrcia*, but assuredly associate much better with the latter than the former genus.

To some it may appear, that this is too sweeping a reform and that these extensive reductions are neither required nor justified in the case to which they are applied. Should such an objection be urged, I have only to reply that, the most sedulous examination has not shown me how otherwise the difficulties I have indicated can be obviated, unless by the formation of additional genera each as artificial as those I propose to reduce.

My first thought was to form new genera and I had actually prepared definitions for two, amply distinguished so far as paper distinctions were concerned, but which, when compared, not with written characters but with their congeners, by laying the specimens side by side and minutely comparing the whole in every part, marking the gradual transitions of external forms, the uniformity of internal structure, in the organs of fructification, and finally the general uniformity of habit, I saw no alternative but to proceed as I have done and at once reunite the species, now distributed under *Eugenia, Caryophyllus, Jambosa, Syzygium* and *Acmena* into one vast genus. The correctness of this view I shall endeavour to establish by, in the first instance, presenting here a synoptical arrangement of nearly all the Indian species of the tribe *Myrteae* with which I am acquainted, and afterwards largely illustrating the genus *Eugenia* by devoting many plates to its elucidation in my Icones.

The characters I have assigned to the genera are brief but comprehensive, being anxious to avoid the introduction of any terms not absolutely required or in any way tending to exclude by unnecessary refinement, any species that really belong to them.

Of the following genera *Eugenia* is by far the largest, exceeding in the number of its species all the others put together, and as its species present among themselves a considerable variety of form, it became absolutely necessary to distribute them into sections or sub-genera to facilitate the determination of the species. The plan I have adopted for this purpose aims at keeping together, as much as possible, the species referred by DeCandolle and others to the several genera I have reduced. By this means comparatively little inconvenience will be caused as each sub-genus retains the name it bore as a genus. The characters of these sub-genera are necessarily somewhat arbitrary and, on a few occasions, scarcely applicable to some of the species referred to them. This however is unavoidable in a genus so natural, and it is hoped, will not be objected to as figures of all such will be given in the Icones. The characters of the sub-genera are almost entirely taken from variations of the calyx, which are always obvious, aided by the inflorescence which is equally prominent. Two of these sub-genera are again divided into sections by the inflorescence being terminal or lateral. This last character, though in common use, I have found of difficult application in practice and very liable to mislead unless restricted by definite rules. These I have endeavoured to supply by considering all those lateral which spring from old wood, such for example, as from the ramuli of previous years or naked branches from the scars of fallen leaves : while those arising from young leafy shoots of the same season and forming a terminal corymbus, though all axillary I have considered terminal. By adhering to this rule I have in one or two instances referred specimens with terminal cymes to lateral sections, because the peduncles really rose from old wood and were only accidentally terminal, through the abortion of the shoot of the current season, which was proved by other instances where it was produced. Thus limited I have found this a good character as indicating a marked peculiarity of habit.

The great number of species referable to the sub-genus *Syzygium* rendering a further division necessary, I then had recourse to the petals, grouping those with cohering petals in one section and those with free expanding ones in another. This I at first expected to find a character of easy application, but in practice was disappointed, as both, not very rarely, occur in the same plant. All but one of those referred to the latter section have most unequivocally the habit of *Syzygium* but with the free expanding petals of *Jambosa* and easily form the transition to that genus.

SYNOPTICAL ARRANGEMENT OF INDIAN MYRTACEÆ OF THE TRIBE MYRTEÆ GENERA.

Genera.

Sonneratia, (Lin. fil.) *Psidium* (Lin.) On these genera I have no remarks to offer. They are principally remarkable, in the tribe, for the numerous cells of their ovary.

Nelitris. Flowers quaternary or quinary: ovary 4 (?) to 10-celled, with fleshy partitions between the cells: ovules solitary in each cell, ascending, reniform.

2. Myrtus. Flowers quinary. ovary 3-celled, with numerous superposed ovules in each: seeds several, subreniform curved, testa hard, embryo cylindrical, curved.

3. Jossinia. Flowers quaternary: ovary 2-celled, placentas central, covered with numerous ovules: fruit 2 or 1-celled, by abortion, seed several, testa soft, cotyledons foliaceous (within a sparing albumen?)

4. Monoxora. Flowers quaternary: ovary 1-celled, with two parietal placentas: ovules numerous: fruit drupaceous containing several nuts (4 in two that I examined) nuts 3, or, by abortion, 1-celled, with a cylindrical curved embryo in each cell.

5. Piminta. Flowers quaternary or quinary: ovary 2-celled; ovules 1 or several in each cell, pendulous from a projecting placenta: seed 1 or several in each cell, subreniform, testa thin, soft: embryo cylindrical, spirally involute, cotyledons conferruminate enclosed in a soft gelatinous albumen.

[This genus includes *Eugenea pimenta* α and β D.C. the latter *Myrcia acris*, and perhaps *M. pimentoides* of the same author. The very unusual position of the ovules, added to the peculiar seed, curved cylindrical embryo and gelatinous albumen—like some of the convolvuli—leave no doubt as to this genus being equally distinct from *Myrtus*, *Myrcia* and *Eugenia*, with all of which its species have been confounded.]

6. Eugenia. Flowers quaternary rarely quinary or with numerous petals: ovary 2-celled, placentas axillary; ovules numerous: fruit subdrupaceous 2 or 1-celled, by abortion, with one or two seed: seed usually globose; cotyledons thick and fleshy, variously lobed or conferruminate, radicle small between the cotyledons.

Sub-Genera of Eugenia.

1. Eueugenia. Limb of the calyx, 4-parted down to the ovary. Pedicels axillary one-flowered.

2. Jambosa. Calyx tube turbinate, rarely cylindrical: limb produced considerably beyond the ovary, cup-shaped, margin 4-cleft. Cymes lateral or terminal; flowers usually large; fruit often edible.

3. Caryophylus. Calyx tube cylindrical, limb deeply 4-cleft. Cymes terminal somewhat corymbose; flowers highly aromatic; fruit subdrupaceous, succulent one or two seeded.

4. Acmena. Calyx tube long clavate; limb much produced beyond the ovary; margin truncated, entire, or repandly 4 or 5-lobed. Flowers numerous, inflorescence various, racemose or corymbosely panicled; petals 4-5, or numerous (10-12) either free or cohering, calyptriform; fruit small, subdrupaceous.

5. Syzygium. Calyx tube short, contracted, pedicel-like; limb dilated, cup-shaped, much produced beyond the ovary, margin truncated, entire or repandly lobed. Cymes corymbose; flowers small, petals cohering or free; fruit subdrupacious usually one-seeded, sometimes edible.

Nelitris. *Gært.*, *DC.*

Of this genus I have only seen one species *N. paniculata ?* Lind. in which I find the ovary 8-celled with a single ascending reniform ovule in each. Lindley describes the ovary of his *N. paniculata* as 4-celled, hence the doubt expressed as to my plant being the same, though from the same country, Malacca, and its general agreement with his specific character. My plant has a 4-lobed calyx and 4 petaled corolla, both copiously furnished with pellucid dots. So far as I can judge from the ovary only, for the fruit on my specimens are far too young to enable me to form any opinion either of its structure or that of the seed, there seems so much affinity between this genus and *Pomaceæ* as almost to render it doubtful whether it belongs to *Myrtaceæ*.

Myrtus. *Lin.—Gært.*

M. communis a cultivated plant, and *M. tomentosus* are the only true species of this genus I have seen and they differ so widely in some points, from each other, that they seem scarcely referable to the same genus.

Jossinia. *Comm. DC.*

Of this genus I have one species, found on the Shevagherry hills near Courtallum. It has so much the habit of a *Eugenia* that I at first ranked it with that genus; a more careful examination of the seed, even though still immature, has shown that it must be excluded.

J. indica leaves short petioled, obovate spathulate, glabrous on both sides, peduncles axillary, solitary, or congested, sometimes, from abortion of leaves, corymbose on the ends of the branches, one flowered: tube of the calyx globose, clothed with short whitish tomentum, limb 4-lobed, lobes persistent: ovary and fruit 2-celled, seed several in each, testa polished soft; cotyledons foliaceous.

None of the fruit I examined were mature but several were sufficiently advanced to admit of the above points being readily made out, showing clearly that it is neither referable to *Myrtus* nor *Eugenia*, the only genera in this country with which I can compare it.

Monoxora. *R. W.*

The type of this genus is Blume's *Myrtus spectabilis* the one-celled ovary (whence the name) with 2 parietal placentas and several celled nuts, clearly distinguish it from that and all other genera of the order, I accordingly separate it as a distinct genus.

Piminta. *Lind.**

This genus is founded on *Myrtus pimenta* Lin. *Eugenia Pimenta* D.C. and *Eugenia acris* W. and A. Prod. the *E. Pimenta* var β, *ovalifolia* D.C. and *Myrcia acris* and *Pimentoides* D.C.

* This genus was first established by Lindley in Loudon's Encyclopædia of Plants with the following character. Cal. 5. fid. Petals 5, Ovary 2-celled. Ovules solitary appense. Style straight. Stigma somewhat capitate.

It seems curious that plants so long known and extensively cultivated as these, and which have been so often described and figured, should have been at the present time, removed from *Myrtus* to be associated with *Eugenia*.

DeCandolle who was the first to refer these species to the genus *Eugenia*, seems either to have been misled by wrong specimens or had not examined those he had with sufficient care, as he describes the fruit "Bacca globosa 1 sperma. Embryo subrotundus, cotyledonibus conferruminatis non distinctis *toto cœlo ab Icone Gærtner diversis*." The concluding words of this description which I have printed in Italics are so much at variance with what I have observed, that I can scarcely avoid suspecting the seed he examined must have been that of some other tree, given by mistake, for in truth I find Gærtner's figure a most accurate representation, as a comparison with the accompanying figure of mine will show. If therefore D.C. had a genuine specimen, I can only account for the error he has fallen into, by supposing he simply cut the seed across without removing the testa as Gærtner and I have done.

Dr. Hooker published a figure of *Myrcia acris* in the Botanical Magazine, tab. 3153, but curiously enough seems to have taken the drawing from one species and the description from another, as he says the calyx is 4-lobed, but with 5 petals! The ovary is described as being "2-celled with one broad ovule pendent from the top of each cell" but is represented with two ovules. *Eugenia Pimenta* has quaternary flowers and a solitary ovule in each cell, *E. acris* has quinary flowers and several ovules in each cell. There is another circumstance connected with that figure and description which may be alluded to. The seeds of *E. pimenta* and *M. acris*, it is said, are very different "if DeCandolle be correct," but yet, though the *Pimenta* or Jamaica pepper is to be had in every grocer's shop, it does not appear that any attempt was made to ascertain the correctness or otherwise of D.C.'s statement, or determine whether they were so different as he asserts.

Dr. Arnott examined both the ovary and young fruit of *P. acris* and most strangely mistook the true structure of both. The latter was not so much to be wondered at, as his specimens were immature, so are those now before me, but still they are sufficiently advanced to show that this is not a species of *Eugenia*, but is a true congener of *Pimenta*.

I refer two species to this genus, viz.

1.* *P. vulgaris* (Lind.) flowers quaternary ovary 2-celled with a single ovule in each cell.

2.* *P. acris* (R. W. Eugenia acris W. and A.) Flowers quinary, ovary 2-celled, with several ovules in each cell, attached round the edge of a broad free placenta.

EUGENIA.

1. SUBGENUS EUEUGENIA. *Calyx tube short, slightly contracted at the throat; limb 4-parted down to the ovary. Peduncles axillary, one-flowered, bibractiolate at the apex.*

1. *E.* (*Eueugenia*) *Willdenowii* (D.C.)

2.* *E.* (*E*) *bracteata* (Roxb.) Sea Coast, frequent both on the continent and in Ceylon.

These two are very nearly allied species, but I think quite distinct, though it is difficult to define them so as to keep them separate.

3. E. (*E*) *Rottleriana* (W. and A.) Courtallum and subalpine jungles in the southern provinces. This species varies considerably in the size of its leaves but the general form is pretty uniform.

4. E. (*E*) *subcordata* (W. and A.) This I find is a mere variety of *Eugenia Michelii*.

5. E (*E*) *Mooniana* (R.W.) Shrubby, glabrous, leaves pellucid dotted, short petioled, ovate, tapering at the base, acuminated; acumen either short and blunt or prolonged and tapering to a fine point: peduncles axillary, solitary or sometimes paired, one flowered: flowers small, calyx tube ventricose, oblong, limb 4-cleft, segments reflexed pointed: fruit globose about the size of a cherry, seed conferruminate.

Ceylon—Moon—*Shevogherry* near Courtallum, R. W.

This species approaches *E. Michelii* but is at once distinguished by its globose not furrowed fruit. Mr. Moon long ago found it in flower in Ceylon but did not name it, more recently I found it in fruit on the Shevagherry hills near Courtallum.

6. E. (*E*) *Mabæoides* (R.W.) Shrubby, very ramous leaves short petioled obovate—spathulate, glabrous, rigid, shining above, pellucid dotted, pedicels very short, fascicled on short subaxillary tubercles: calyx tube ventricose, limb 4-parted: ovary 2-celled with numerous ovules attached to the central placenta; fruit?

Ceylon.—Moon and Watson. This can scarcely be mistaken for any other Indian species I have seen, its rigid habit, small hard shining spathulate leaves and fascicled flowers, give it a good deal the appearance of *Maba buxifolia* whence the specific name.

7. E. (*E*) *Codyensis* (Munro MSS) shrubby, glabrous, leaves short petioled, from ovate oblong to obovate, with a short blunt acumen, tapering towards the base, pellucid dotted: flowers subsessile aggregated, forming terminal capituli on the points of short abortive branches, or they are axillary, solitary, or a few together: calyx tube small, clothed with silky tomentum, somewhat globose; limb persistent, lobes ciliate: petals twice the length of the calyx lobes, ciliate: style and stigma simple: ovary 2-celled; ovules numerous; fruit 1-2 seeded, globose.

Afterwards he appears either to have forgot or become dissatisfied with it, as I do not find the name, even as a synonym, in the list of genera in his Natural System of Botany. Owing to this oversight on his part, I had nearly overlooked it. As it was not until my manuscript was ready for the press that I accidently discovered I was not the first to propose this genus, I publish unaltered my account of it, merely adopting Lindley's name, that which I proposed being somewhat different. His only species was the *Myrtus pimenta* Lin. but as the generic character embraces both my species, I suspect he must either have had them both before him or have taken his character partly from examination and partly from description.

* I am indebted to Dr. Wallich for authentic specimens of all those species marked with a star* in front, in the following list.

Coorg near Mercara—rare: Munro—Fowers sweet scented. This species very much resembles (*)*E. buxifolia* Lam. in the foliage, but appears distinct. DeCandolle refers Lamarck's plant to his genus *Jossinia* and if correctly, which my specimens do not enable me to determine, this species certainly forms the transition from the one to the other.

My specimens and a detailed description, from which the above character is abridged, were communicated by Lieutenant Munro.

2. Sub-genus Jambosa, D.C. *Calyx turbinate attenuated, rarely cylindrical or sub-globose towards the base; throat dilated, produced beyond the ovary 4-cleft, lobes usually persistent: petals free, expanding before falling. Cymes lateral or terminal, flowers usually rather large and conspicuous, sometimes nearly sessile oftener longish pedicelled, fruit often edible.*

§. 1. *Cymes terminal.*

8.* E. (*Jambosa*) *Jambos* (Lin. Jamboa vulgaris, D.C.—W. and A.)

9. E. (*J*) *aquea* (Roxb. J. aquea, D.C.—W. and A.) This seems to be a widely distributed, and, as regards the form of the foliage, a variable species. In some they are nearly oval, in others oblong, and in others nearly lanceolate, they all however agree in being short petioled and, with one exception, in having short peduncles congregated near the summit of branches.

10. E. (*J*) *Munronii* (R. W.—J. aquea, Munro's MSS.) racemes cymose terminal, tube of the calyx much attenuated at the base, lobes of the limb somewhat membranous obtuse: leaves subsessile, slightly cordate at the base, lanceolate upwards, ending in a short blunt acumen, penninerved; veins meeting and forming a thick coarse nerve within the margin: pellucid dotted.—A slender tree from 12 to 20 feet high, flowers large and conspicuous, apparently from the dried specimen, redish. Fruit edible.

Coorg—Lieutenant Munro. This seems a very handsome species.

§. 2. *Cymes lateral.*

a. Short or subsessile calyx turbinate.

11.* E. (*J*) *Malaccensis* (Lin. Jambosa malaccensis D.C.—W. and A.)

12.* E. (*J*) *purpurea* (Roxb.) apparently only a variety of the former.

13.* E. (*J*) *ternifolia* (Roxb.) A noble species but only differing from the two preceding ones in having the leaves in verticels of three together, in place of simply opposite.

14. E. (*J*) *formosa* (Wall. Pl. As. Rar. 2 tab. 108.)

b. Cymes lateral, longish peduneled, tube of the calyx short, hemispherical.

15. E. (*J*) *hemispherica* (R. W.) leaves petioled, lanceolate, acuminated at both ends, cymes axillary solitary or paired, shorter than the leaves: calyx tube short, semiglobose, petals orbicular, reflexed: fruit—*Ceylon.*

A very distinct species, easily known by the unusual form of the tube of the calyx which, in place of being conical like all the others, is dilated and globular. The leaves are about 4 inches long and about 1 broad at the broadest point, whence they gradually taper to both ends, imperceptibly terminating in the petiol below and a fine point above, sometimes subalternate. The peduncles are slender, either solitary and then accompanied by a branch, or paired, bearing from 6 to 9 largish white flowers. The fruit I have not seen. This species forms the transition to *Syzygeæ* in like manner as *E. pauciflora* and *cylindrica* does to *Caryophyllæ.*

c. Cymes longish peduncled, calyx conical, sometimes cylindrical, long and slender.

17. E. (*J?*) *amplexicaulis* (Roxb.)

18.* E. (*J*) *alba* (Roxb.)

19. E. (*J*) *bifaria* (Wall. Pl. As Rar. 2. tab. 161.) The specimens communicated by Dr. Wallich under this name appear to me to belong to a totally different plant. The figure represents a plant so very nearly allied to *E. alba* Roxb. that it seems rather a variety of that than a distinct species, see below *E.* (*S*) *Wallichii.*

20.* E. (*J*) *polypetala* (Wall. List No. 3616) *E. angustifolia* R. not Lamarck.

The numerous petals of this species—12 to 16—seem to render it doubtful whether this should be retained in the genus. It is readily distinguished by that character and the verticilled ternate, not opposite, linear lanceolate leaves.

21.* E. (*J*) *laurifolia.* (Roxb.) The long slender pedicels of this plant combined with its even, not nerved, delicate foliage, render it a very distinct and beautiful species.

22. E. (*J*) *pauciflora* (R. W.) leaves short petioled, lanceolate, attenuated towards the base, ending in a long slender acumen: pedicels solitary from the extreme axils, one-flowered: calyx tube cylindrical long and slender, limb 4-cleft, fruit oval.

Ceylon—Courtallum. This species seems very nearly allied to the following, but the solitary one-flowered pedicels common to the plant both as fouud in Ceylon and on the continent at once distinguish it.

23. E. (*J*) *cylindrica* (R. W.) leaves short petioled, ovate, acuminated at both ends: cymes termiual or from the axils of the last two or three pairs of leaves; calyx tube cylindrical loug and slender, fruit ——?

Ceylon. The tube of the calyx in both these species is nearly an inch long, slightly ventricose near the middle, where the ovary is situated, and thence tapering downwards to a point.

These three species form the transition to *caryophyllus* and, had the calycine arrangement here followed, been rigidly adhered to, the cylindrical elongation of the calyx would have placed the two last in that sub-genus: but their affinities being truly with *Jambosa* I prefer bringing them in here.

3. Sub-genus Caryophyllus (Lin). *Calyx tube elongated, sub-cylindrical, limb deeply 4-cleft, lobes persistent: petals cohering, calyptriform, cymes terminal or at least confined to the axils near the summits of the branches.*

16. *Caryophyllus aromaticus* (Linn.) Some, at least, of the other species referred to this genus by DeCandolle, seem scarcely to belong to it but are allied to my *E. cylindrica* or referable to the following sub-genus.

4. Subgenus Acmena D.C. *Calyx tube elongated,*

conical, limb produced beyond the ovary, truncated or repandly 4-5 lobed: petals 4-5, sometimes calyptrated, sometimes free and expanding (even in the same species), fruit subdrupacious.—Flowers numerous subsessile lateral, sometimes forming lateral spicate racemes, sometimes terminal racemose panicles.

The flowers of this subgenus being frequently quinary —having a 5-lobed calyx and 5-petaled corollo—indicate it as the transition towards *Myrtus*, *Myrcia* and *Pimenta*, in which both quinary and quaternary flowers occur and one species has numerous petals like *E.* (*J.*) *polypetala*: the seed however mark it as a true Eugenia.

24. E. (*A*) *claviflora* (Roxb. Fl. Ind. 2—p. 488.)

25. E. (*A*) *leptantha* (R. W.) Leaves oval, acute or acuminated at both ends, finely parellely veined : racemes spicate, lateral, from naked branches: calyx tube long, clavate, finely attenuated towards the base ; limb dilated and much produced beyond the ovary, margin slightly repand : petals usually 5, caducous, calyptriferm ? Fruit ? *Mergui.*—Griffith.

So far as I can make out from Roxburgh's imperfect character, this seems very nearly allied to his *E. claviflora.*

26. E. (*A*) *Wightiana* (R. W.—Syz. Wightianum Wall.—W. and A.) calyx repandly 4-lobed, petals 12 or fewer by abortion ; the outer ones occasionally expanding.

This species owing to its numerous petals seems to hold the same rank in this subgenus that *E.* (*J*) *polypetala* does in *Jambosa.*

27. E. (*A*) *lanciolata* (Lam.)

These two are apparently nearly the same, Lamarck's description of the flowers of his *E. lanceolata* (Elles sont glabres, turbinees ou en massue et ont le calice a quatre lobes : leur style est simple;) is so far as it goes quite applicable to those of Wallich's *S. Wightianum*, and the foliage, making allowance for occasional variation, is also sufficiently in accordance. But I have another species from Ceylon which is so like that I for a long time thought it the same, but which, on closer examination I find differs both in the venation of the leaves, and in the flowers. The flowers accurately correspond with Lamarck's description ; the stamens, as in his specimen, have all separated leaving the simple style.

28. E. (*A*) *Zeylanica* (R. W.) Myrtus Zeylanica Linn.—Syzygium Zeylanicum et spicatem (D.C.) Acmena parviflora ? (D.C.)

This in foliage is a variable species but the inflorescence is sufficiently uniform to mark it under every variation. I have now specimens from *Malabar*, *Ceylon* and *Mergui*, which sufficiently agree in that particular, though the foliage is somewhat different. This plant agrees so well with the character of *Acmena parviflora* (D.C.) that I have no hesitation in quoting that as a synonym, a view in which I am further confirmed by the character of the fruit of *A. floribunda*, *β*, *elliptica*—viz. " bacca globosa alba" which accurately describes that of E. (*A*) *Zeylanica.*

29.* E. (*A*) *grata* (Wall.) calyx conical, limb repandly 5-toothed : petals 5-corymbs: terminal and from the upper axils : leaves ovate lanceolate, ending in a longish blunt acumen: fruit globose 1-2-seeded,crowned with the projecting throat of the calyx—*Mergui.* Griffith—*Assam.* Jenkins and Griffith.

This species seems very distinct from all the others of this sub-genus, but seems certainly referable to it both on account of the elongation of the tube of the calyx and the quinary tendency which its flowers exhibit, the globose fruit affords another mark of relationship with the preceding.

30.* E. (*A*) *oblata* (Roxb. *Syzygium* oblatum Wall.) This species is nearly allied to the last, so much so indeed, that I doubt whether they can be kept separate.

31 E. (*A*) *bractiolata* (R. W.) ramúli 4-sided, angles subacute : leaves short petioled, elleptico-lanceolate, acute or slightly acuminated at both ends, pellucid dotted : cymes terminal and from the upper axils, the extreme divisions terminating in a cluster of from 6 to 9 sessile flowers ; each division and each flower furnished with two minute, persistent, acute bracteols : calyx tube conical 4 sided ; limb repandly 4 lobed.

I am uncertain whence I received my specimen but I think from Mergui.

This species evidently forms the transition from *Acmena* to *Syzygium*, the glomerate flowers and conical calyx tube marking its relationship with E. (*A*) *Zeylanica* while its diminutive length and 4 not 5 toothed margin show its affinity with *Syzygium.*

5. Subgenus Syzygium (Gært.) *Calyx tube short, that part enclosing the ovary contracted (pedicel-like) inconspicuous, limb (beyond the ovary) dilated, cup-shaped, persistent, truncated, entire or repandly 4-toothed, petals either free and expanding or cohering calyptriform. Trees often of great size ; flowers numerous, small, white, limb of the calyx usually deciduous, cymes corymbose lateral or terminal.*

§. 1. *Petals cohering and separating in that state.*

a. Cymes terminal, that is, from the upper axils of the young shoots of the same season.

32. E. (*S*) *rubicunda* (R. W.—S. rubicundum W. and A.)

33. E. (*S*) *Neesiana* (R. W.—Syzygium Neesianum Arnott's pugillus) leaves subsessile, oblong lanceolate, blunt pointed, subcoriaceous, pellucid dotted, penninerved : cymes terminal, laxly corymbose, trichotomous, peduncles 4-sided,the partial ones umbellately 3-7-flowered, pedicels half the length of the shortly turbinate slightly 4-lobed calyx—Arnott. *Ceylon.*

This species seems to have a nearly equal right to a place in both sections of this sub-genus as the petals are often free. Dr. Arnott remarks that it differs from all the other species of the genus in its sessile leaves, this is certainly an excellent character but not without exception, as I have, what appears to me, a petioled variety of this plant and another species with sessile leaves

34.* E. (*S*) *Myrtifolia* (Roxb. Fl. Ind. 2, P. 490.)

35.* E. (*S*) *Oleina* (R.W.—Syzygium oleinum Wall.) These two, if distinct, are so like each other that I cannot see by what characters they can be defined, I look upon them, judging from specimens only, as identical.

36. E. (*S*) *sylvestris* (Moon) leaves obovate obtuse or spathulate, coriaceous, shining, short petioled : cymes corymbose, congested towards the summits of the branches and extreme axils, longish peduncled : fruit about the size of a crab-apple, redish.

Ceylon.—Most of the above character is copied from Moon's notes on this species.

37. E. (*S*) *Caryophyllæa* (R. W. Syz. Caryophyllæum

Gært.) This species varies considerably in its foliage, being sometimes broader than long, at others spatulate, more rarely lanceolate, or merely a little broader upwards. It is however a very distinct species.

b. Cymes lateral (i. e.) from year old branches.

38. E. (*S*) *reticulata* (R. W.) leaves ovate lanceolate, acuminated, thick and coriaceous; when dry, brownish beneath and finely reticulated with slender whitish veins: cymes axillary, corymbose, trichotomous: limb of the calyx much dilated, 4-toothed: flowers large. *Assam.* Griffith.

Judging from specimens only, this appears a rigid, very ramous tree, the leaves have much the texture and appearance of those of *Buchanania* or *Mangifera.* The flowers are about the largest of the sub-genus and very numerous.

I am indebted to Mr. Griffith for my specimens of this plant.

39. E. (*S*) *alternifolia* (R. W.) leaves alternate! suborbicular, thick and coriaceous, penninerved: cymes lateral, longish peduncled, corymbose, dense, sometimes congested near the apex of year old branches: calyx truncated entire: petals calyptrated. *Balaghaut Mountains* near Madras.

A noble species, the leaves, which are nearly orbicular, being sometimes upwards of 7 inches across, very thick and coriaceous. The flowers are large, forming dense clusters in the axils of the leaves, apparently pure white. It seems nearly allied to *E. cymosa* Roxburgh and *E.* (*S*) *densiflora* Wall., being generally very like that species, but differs in the calyx being entire and the petals cohering.

40. E. (*S*) *cordifolia* (R. W. Calyptranthis cordifolia, Moon) leaves coriacious penninerved, ovate, accuminate, sessile, cordate, stem clasping, at the base: cymes corymbose, longish peduncled axillary, shorter than the leaves: calyx limb very slightly 4-toothed, petals calyptriform.

Ceylon. Moon and Colonel Walker.—This is a large handsome species. The leaves are upwards of 6 inches long and nearly 3 broad, very coriacious, revolute on the margin; flowers pretty large; the fruit I have not seen.

41.* E. (*S*) *Jambolana* (Lam. Syz. Jambolanum DC. &c.) This like many other widely diffused and cultivated plants is a sufficiently variable species, and under this name may I suspect be ranged, in addition to the already long list of synonyms, *E. fruticosa* Roxb. at least so far as can be determined from specimens. Roxburgh seems to have looked more to habit than characters in constituting this last a distinct species, the characters of the two, though varying in words, being the same in substance, that is, whatever character is assigned to the one I find equally in the other when compared.

42.* E. (*S*) *fruticosa* (Roxb. Fl. Ind.)

43. E. (*S*) *salicifolia* (R. W. Syz. salicifolium Graham's Cat. Bombay plants) leaves linear lanceolate, tapering towards both ends, obtusely acuminated, transversely finely parallel veined, pellucid dotted, cymes numerous, trichotomous, small, from the scars of fallen leaves: flowers small: fruit—*Ghauts near Bombay.* Graham.

This seems distinct, but is certainly very near *E.* (*S*) *Jambolana.* It may be *S. lineare* or *S. salicifolium* Wall. which however, so long as I have no description nor authentic specimens of either to compare, must remain doubtful. The younger leaves when held between the eye and the light present a most beautiful net-work of transparent veins but without pellucid dots, when older, the reticulations nearly disappear and are succeeded by pellucid points.

44. E. (*S*) *Odorata?* (R. W. Syz. odoratum D.C.) leaves ovate, lanceolate, attenuated towards the base, with a blunt short acumen at the apex, glossy above, pale glaucous and transversely veined beneath, cymes corymbose, diffuse, each floriferous division ending in a cluster of from 6 to 9 small sessile flowers. *Mergui*—Griffith.

DeCandolle describes his *S. Odoratum* as having impunctate subcoriacious leaves. The leaves of my plant are coriacious and the older ones are impunctate, but when younger ones which have not altogether lost their translucency are examined, pellucid dots can be detected. He describes the peduncles as terminal, which in truth in most of my specimens they are, but, owing to their springing from the scars of fallen leaves, on one year old wood I refer it to this, as its true section.

45. E. (*S*) *Toddalioides* (R. W.) leaves lanceolate, attenuated towards the base, ending in a long narrow acumen above, coriaceous, transversely parallelly veined, pellucid dotted: cymes lateral di-trichotomus, each branch bearing 1-2 or 3 flowers: limb of the calyx much dilated, tube contracted not thicker than the pedicel. *Mergui*—Griffith.

The leaves of this species have the peculiar venation observable in species of *Xanthoxylon* and *Toddalia*, whence the name, and being similarly perforated with pellucid dots, the species, not in flower, might be supposed referable to that order. The flowers are few, scattered in small cymes along the naked branches.

46.* E. (*S*) *balsamea* (R. W. Syzygium balsameum Wall.) leaves obovate, lanceolate, atenuated towards the base, transversely veined, pellucid dotted: cymes corymbose small, several often springing from the same axil, much shorter than the leaves: calyx entire not toothed—*Assam*—Capt. Jenkins.

This is a very distinct species and easily recognized by its numerous short, but many flowered cymes, several springing from each axil or scar of a fallen leaf along the naked branch. My specimens are partly communicated by Dr. Wallich from the Calcutta Bot. Garden, partly by Captain Jenkins from Assam, neither however in fruit.

47.* E. (*S*) *operculata* (Roxb.—Syz. nervosum D.C.)

48.* E. (*S*) *tetragonum* (R. W. Syzygium tetragonum Wall.) stems 4-sided, angles winged: leaves, oblong-ovate, attenuated at both ends, penninerved, marginal nerves prominent; cymes lateral trichotomous, much shorter than the leaves: fruit globose about the size of a large pea.

This species seems very closely allied to the former, the decidedly 4-sided 4-winged ramuli seeming to form the only really available distinction, unless the absence of pellucid dots, which I cannot detect in the specimens before me, form another Communicated by Dr. Wallich.

49. E. (*S*) *androsæmoides?* (D.C. Myrtus androsæmoides Lin.) leaves from broad oval to obovate-suborbicular, coriacious, glabrous, short petioled, not shining, pellucid dotted: cymes lateral trichotomous diffuse: fruit about the size of a small pea, crowned with the dilated margin of the calyx, 1 seeded. *Assam*—Capt. Jenkins.

The specimens from which this character is taken were communicated by Captain Jenkins but are not very good. The leaves in their general appearance greatly resemble some of the broad-leaved varieties of *Combretum ova-*

lifolium. It seems very distinct from all the other species of the genus I have seen.

§. *Petals usually free and expanding before falling off.*

The plants referred to this section are few and I have found some difficulty in determining what really belong to it, from free and cohering petals occurring in the same species. Such being the fact the sectional character must be received with some latitude.

Cymes lateral.

50.* E. (*S*) *Wallichii* (R. W.—E. bifaria Wall. MSS.) The species figured by Wallich under this name does not resemble the specimens so named and communicated by Dr. Wallich himself, as well as received from both *Mergui* and *Assam.* The plate, judging from the size ot the flowers, their short pedicels and the small number on each cyme, clearly represent a *Jambosa,* (I think *Eug. alba R.*) while the specimens leave no doubt of their belonging to *Syzygium* and, as if to place the matter beyond a doubt the petals appear as often, much oftener indeed, to cohere and separate as a lid than expand; my first thought therefore was, before attentively examining the specimens and comparing them with the figure, to place it between *E.* (*S*) *balsamea* and *operculata,* which, judging from the specimens only, seems the proper place for it, except, that the calyx is more deeply cleft than is usual in that section, and it is in all respects so closely allied to the following that I cannot think of separating them.

51. E. (*S*) *polyantha* (R. W.) leaves penninerved oval lanceolate, tapering at the base, bluntly acuminated, coriaceous, dotted, shining above, dull, somewhat glaucous beneath: cymes numerous, short, many-flowered, several springing together from the scars of fallen leaves: calyx 4-cleft, petals 4, constantly expanding before falling: fruit. *Mergui*—Griffith.

In dried specimens, this species is easily known by the shining deep brown colour of the upper surface of its leaves, compared with the pale dull colour of the lower, and by the flowers, the petals of which in this species always expand, though, in all other respects, they resemble the most perfect species of *Syzygium.* It is very nearly allied to the preceding.

52. E (*S*) *cymosa* (Lam. Rumph. Amb.: 1 tab. 41) leaves short petioled, finely transversely veined, oval, acuminated, somewhat waved on the margin, acumen blunt pointed: cymes corymbose, contracted, trichotomous, few-flowered: flowers subsessile, clustered on the points of longish peduncles: calyx slightly lobed, petals free expanding.—*Mergui*—Griffith.

This is certainly a beautiful plant, and though in character not easily distinguished from the preceding, is yet very distinct. The leaves want the course conspicuous nerves, being quite even on both sides, the nervation resembling that of a *Calophyllum* plant, the midrib only conspicuous. The cymes, though as a whole small, yet seem to have long branches,the flowers being confined to their points and capitulate. The fruit I have not seen.

Cymes terminal or from the axils of young shoots.

53. E. (*S*) *rubens* (Roxb.) "Leaves short petioled opposite and subalternate, lanceolar obtuse, fine veined hard and glossy: panicles terminal, ultimate divisions often unbelliferous.—R. Fl. Ind. 2. 496.

I have specimens from *Mergui* which answer, generally, exceedingly well to the above description, the under surface of the leaves of which, are of a rusty redish colour while the upper is glossy and very hard.

54.* E. (*S*) *inophylla* (Roxb. Syz. inophyllum DC.) The petals of this species being free and expanding, with a tendency to the terbinate calyx of Jambosa, DeCandolle must have referred it here rather from habit than on account of its agreeing with his generic character. It has much the habit of Syzygium but not the calyptrated petals.

55. E. (*S*) *rovoluta* (R.W.) leaves short petioled obovate, very obtuse, revolute on the margin, very coriaceous, penninerved, polished above, dull glaucous beneath: cymes terminal longish peduncled, flowers sessile congested on the points of the floriferous ramuli: calyx 4-5-toothed: petals usually free sometimes cohering—*Ceylon*—Colonel Walker.

This species varies much in size and somewhat in the shape of the leaves—the smaller leaved varieties having them from oval to obovate lanceolate, while the larger ones are very broadly obovate, but all are very hard and coriaceous and, at least when dried, revolute on the margin.

My specimens were partly communicated by Colonel Walker and partly collected by myself.

56. E. (*S*) *Arnottianum* (R. W. Syz. densiflorum W. and A.) DeCandolle's *Jambosa densiflora* claims precedence in the name.

57.* E. (*S*) *grandis* (R. W. E. cymosa Roxb. Fl. Ind. not Lamarck.) A magnificent species at once distinguished by its large broad oval, very obtuse, thick coriaceous leaves, and dense somewhat capitate many flowered cymes. *Mergui*—Griffith *Silhet*; My specimens from Mergui correspond accurately with those communicated by Dr. Wallich from the Botanic Garden Calcutta.

In a circular arrangement of the order the species of this section would form the transition to *Jambosa,* and so far as I am able to form an opinion on the subject, from the very imperfect materials now before me, I think it probable *Jambosa* will be found to form the typical group of the circle, Eueugenia the sub-typical and the other three sub-genera the aberrant. This, however, can as yet only be surmised, as it is impossible to determine the sequence of a genus until the whole order has been carefully analysed.

The places of the following species remain to be determined the character of the petals being unknown to me.

E. (*S*) *rotundifolia* (S. rotundifolium. Arn. pugil.) "Shrubby, leaves approximated, very short petioled, orbicular, subretuse, coriaceous scarcely punctuated, above glossy veinless,beneath penninerved: cymes terminal sessile capituliform few-flowered: calyx obovate shortly 5-toothed—Mountains of Ceylon: 6000 feet of elevation."—Arnott.

From the examination of an imperfect specimen of the plant now before me, I should rather describe the calyx as 4 than 5-toothed, in all other respects the character accords accurately with the specimen.

E. (*S*) *calophylifolia* (R. W.) shrubby, ramuli 4-sided: leaves approximated, from obovate suborbicular to oval, very obtuse, coriaceous, smooth, dull, not shining, veinless above, penninerved beneath, slightly revolute on the margin, cymes terminal, corymbose, short peduncled, many-flowered, calyx limb repaudly 4-toothed, petals 4 orbicular expanding (?) before falling.

Ootacamund, Neilgherries.

This is quite distinct from, though evidently nearly al-

lied to, the preceding. The specific name is in allusion to the striking likeness in the form of the leaves, to those of *Calophyllum Walkerii* tab. 45 of the preceding volume.

I am necessarily forced to pass over, unnoticed, many species only known to me from description, often not very perfect, but as my object is to sketch an arrangement, it would tend to destroy its usefulness were I to introduce species unknown to me as they might chance to be placed in wrong sections, or might not even belong to the genus. The following species I have ascertained from the examination of specimens must be excluded.

Eugenia laurina! Moon's catalogue, is a species of *Symplocos*.

Eugenia capitellata (Arn. Pugillus) is a species of *Memecylon*.

Had I felt the slightest wish to extend the list of species, I believe, the materials in my possession would have enabled me without difficulty to have done so, but being anxious on the contrary rather to reduce than extend the list of doubtful species I have been careful to add none of my own on which a doubt can exist. Most of those I have named as new species, will shortly be figured in the Icones.

EXPLANATION OF PLATE 97,* OR 122.

FIG. 1. *A*—Section of the base of a very young ovary of the Pomegranate, showing the lower series of carpels, 4 in number, with a single central placenta in each cell.

B—Another section of the same ovary, showing the upper series in this instance 6 in number, each having a single parietal placenta—These two figures are taken from opposite sides of the same slice.

FIG. 2. *C.D*—These are sections of another ovary somewhat further advanced, showing the derangement caused in the lower series of carpels by the growth of parts in a very confined space.

C. The lower series.—*D.* The upper series of carpels; in this instance 7 in number. These two sections as in the former instance are taken from opposite sides of the same slice.

FIG. 3. *Myrtus tomentosa.* 1. Flower front view, about the *natural size*—2. Side view, petals removed—3. A petal detached—4. Stamens—5. Ovary cut transversely, 3-celled, with 2 rows of ovules in each cell—6. Ovary cut vertically showing the superposed ovules (but they are much more numerous than here represented)—7. A fruit nearly full grown, cut transversely—8. A detached seed—9. The same longitudinally, showing the form and position of the embryo.

FIG. 4. *Jossinia indica*, (R. W.) 1. Young fruit, covered with its persistent calyx, *natural size*—2. The same, the pericarp removed bringing into view a cluster of aborted ovules lying on the side of some considerably advanced—3. The fruit cut vertically, showing several seed considerably advanced towards maturity—4. An immature fruit cut transversely, 2-celled—5. A seed—6. The same cut transversely—7. Cotyledons detached,

FIG. 5. *Monoxora spectabilis*, (R. W.)—1. A flower side view, *magnified*—2. The same, petals removed—3. Stamens—4. Ovary cut vertically—5. Cut transversely—6. A young fruit—7. one nearly mature cut transversely, showing the nuts *in situ*—8. A nut detached—9. The same cut lengthwise showing one of the cells with its enclosed seed—10. Cut transversely 3-celled—The shell of these nuts is exceedingly hard.

FIG. 6. *Pimenta acris*, (R. W.)—1. A flower side view—2. The ovary, after the fall of the petals and stamens, crowned by the limb of the calyx—3. Stamens—4. Ovary cut transversely, showing a portion of the broad free placenta—5. Cut vertically showing the placentas and their attached ovules *in situ*—6. A placenta and ovules detached—7. A fruit not quite mature, *natural size*—8. The same cut transversely—9. A seed, nearly mature—10. The same, the testa removed showing the spirally involute embryo—The glutinous albumen which surrounds this seed, I could not show in a drawing.

FIG. 7. *Pimenta vulgaris*, (Lind.)—1. A flower side view—2. The same, stamens and petals removed to show the lobes of the calyx—3. Stamens—4. Ovary cut vertically showing the pendulous solitary ovules—5. Ovary cut transversely, 2-celled—6. A fruit nearly mature—7. A seed full grown—8. The same, the testa removed to show the spirally involute embryo—9. The embryo cut longitudinally.

FIG. 8. *Eugenia* (*J.*) *hemispherica* (R. W.)—1. A flower about the period of expansion—2. The same cut vertically, showing the incurved stamens and position of the ovary—3. Front view of the petals after the fall of the stamens—4. Stamens—5. Ovary cut vertically—6. cut transversely.

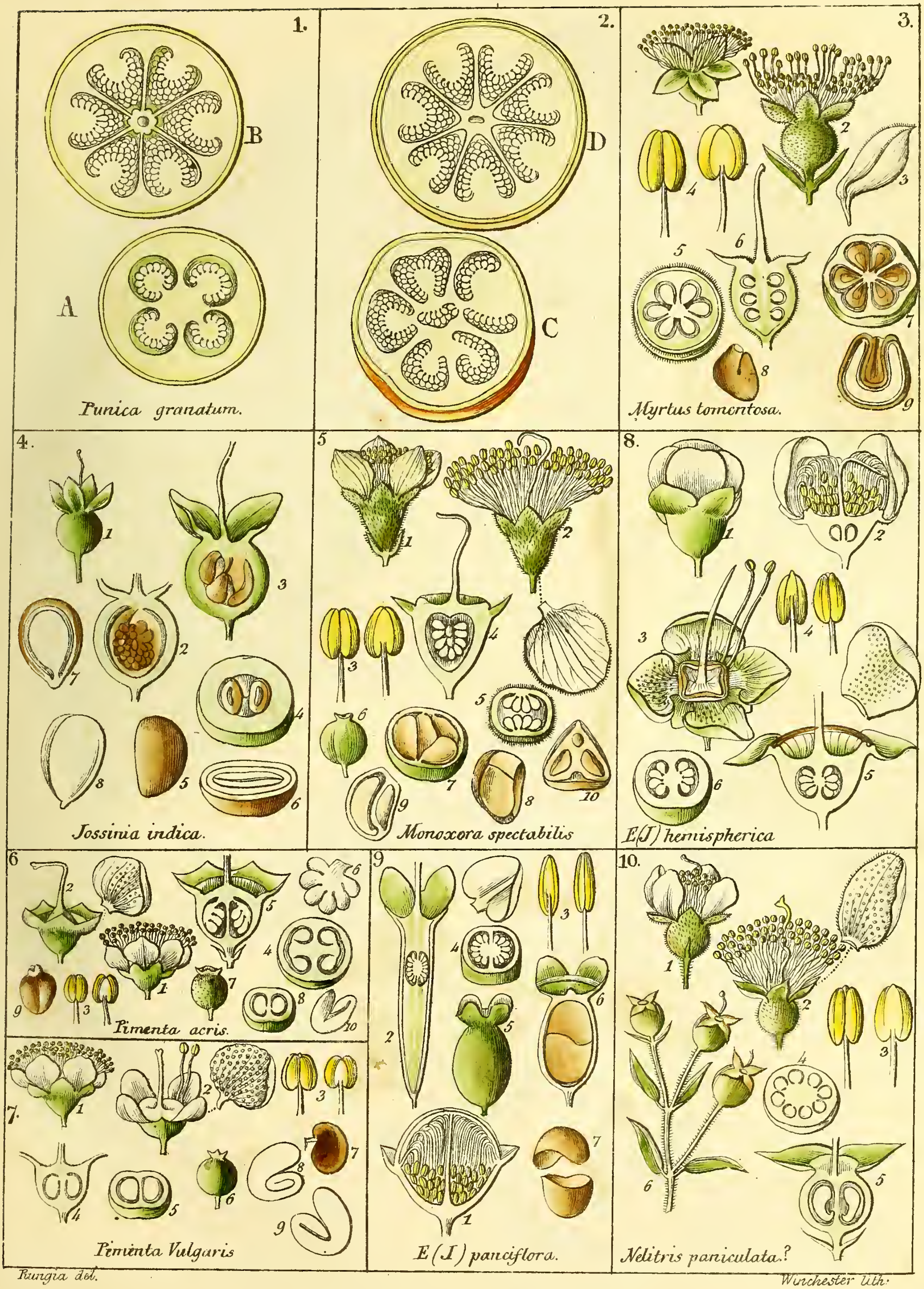
FIG. 9. *Eugenia* (*J.*) *pauciflora* (R. W.)—1. A flower cut vertically, showing the position of the stamens in the bud—2. Tube of the calyx cut longitudinally showing the place of the ovary (about the *natural size*)—3. Stamens—4. Ovary cut transversely—5. A fruit somewhat reduced—6. Pericarp removed, showing the seed *in situ*—7. The seed transversely 2-lobed.

FIG. 10. *Nelitris paniculata?* (Lindley)—1. Flower side view—2. The same, petals removed—3. Stamens—4. Ovary cut transversely, 8-celled—5. Ovary cut vertically, showing the solitary reniform ovules—6. A raceme of young fruit.

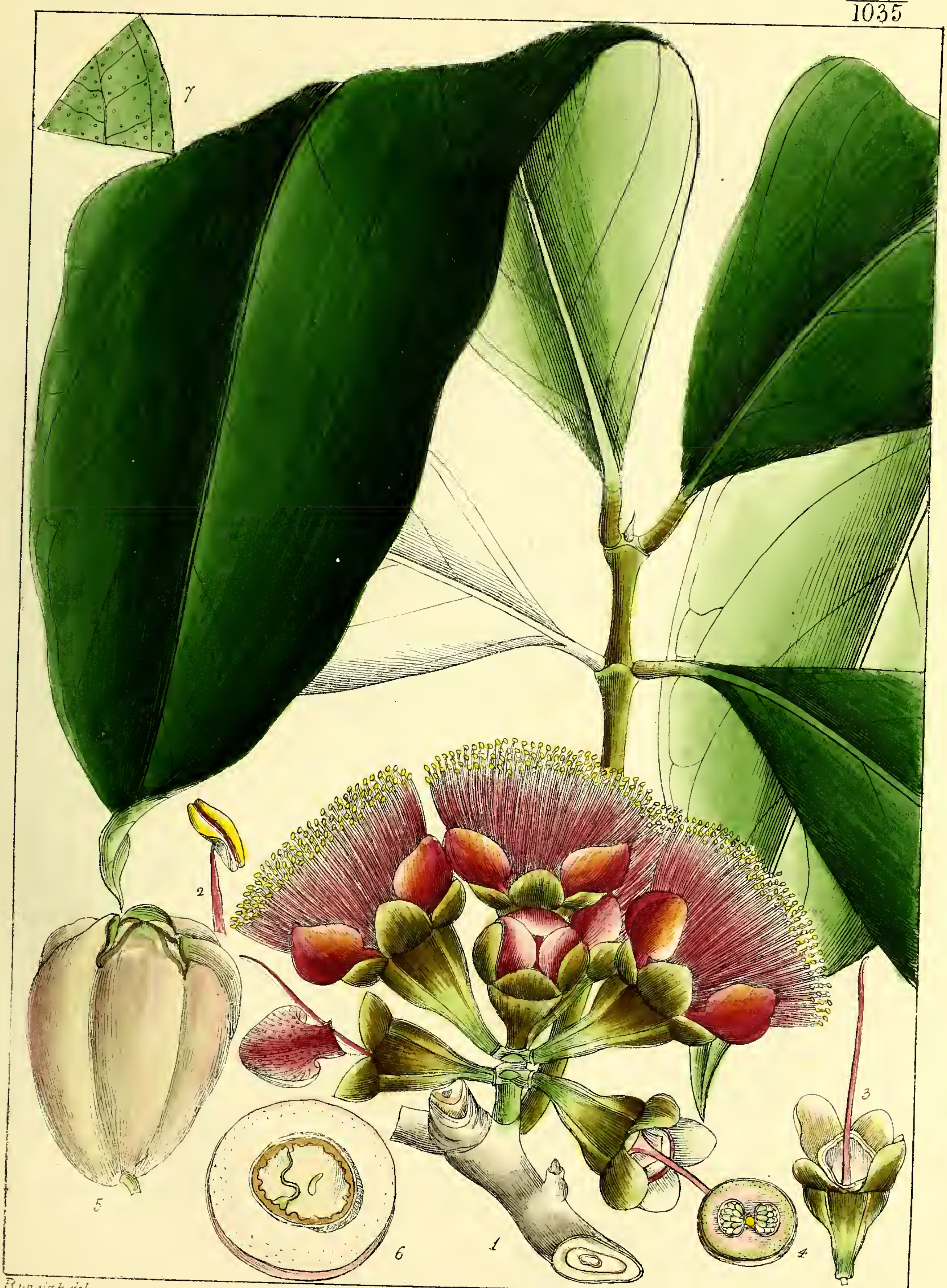
EXPLANATION OF PLATE 98.

Eugenia (*Jambosa*) *Malaccensis*—*Jambosa Malaccensis*, D.C.—1. Flowering branch—*natural size.*

2. An Anther.
3. Ovary and calyx.
4. Ovary cut transversely.
5. A fruit, near maturity.
6. The same, cut transversely.
7. A portion of a leaf magnified to show the pellucid dots—*all more or less magnified.*



GENERA OF MYRTEÆ.



Rungiah del. Winchester Lith.

JAMBOSA MALACCENSIS (DC)

Jemboonagamarum } Tam.

జంబునేరడి చెట్టు
Jemboonaradeechettoo } Tel.

Sub-order Barringtonieæ.

This is a small tribe including, according to Lindley, only seven genera, two of which *Barringtonia* and *Careya* are found in continental India. Respecting this sub-order Dr. Lindley remarks " No characters have yet been assigned to these plants by which they may be known from *Myrtaceae*, except their alternate leaves without semi-transparent dots, and the presence of stipules. The latter peculiarity which has been assigned to them by Von Martins does not exist in any of the species I have examined, so that the substantial distinction is reduced to the first mentioned. There is, however, something so peculiar in the appearance of these plants, that one can hardly doubt that some good characteristic mark will be one day added to those they already possess."

One such mark certainly does exist in the seed, which Roxburgh correctly describes as having a simple inverse embryo the length of the ample perisperm or albumen as it is now called, and pointedly remarks on the similarity existing between the seed of these plants and some *Guttiferae*; a very sufficient distinction between them and true *Myrtaceae*, in which no such structure is known to exist. Hence it appears that, however closely allied by the flower, they are essentially distinct as regards properties, structure of the seed, and mode of germination. These are powerfully aided by habit, that is, by their alternate often serrated leaves without pellucid dots and by their 4 rarely 2-celled ovary, than which, it appears to me, distinctions of much less value have been allowed to divide as nearly allied families. This last, I am well aware, is an argument of no weight, as it does not necessarily follow, that, because we have fallen into one error another should be committed to keep it in countenance, and would not have been used, had I felt any doubt of their being distinct. On these grounds I view *Barringtonia, Careya, Fœtidia* (the ovary of which I have examined) and some others, as forming, if not a distinct order, at least a well marked sub-order of *Myrtaceae.*

Geographical Distribution. Seven or eight genera have by different authors been referred here: three of these are of Indian origin, viz. *Barringtonia, Careya,* and *Glaphyria,* the last a native of the Moluccas, unknown to me. The other two are widely distributed over India. One (*Gustavia*) is common to tropical America and Java, and all the others doubtfully referred here, are entirely American or West Indian.

Properties and Uses. Little seems to be known respecting these. The bark of *Barringtonia* (*Stravadium*) *racemosa* is somewhat bitter and is said by Dr. Ainslie, on the authority of the vitians to have properties similar to *Cinchona*, while the root is considered valuable on account of its cooling aperient and deobstruent properties. Of *Gustavia speciosa* Dr. Lindley (Flora medica) remarks " according to Humboldt and Bonpland children are very fond of the fruit and become quite yellow after eating it, but in 24 or 48 hours they regain their natural colour without any remedy." The species of both *Barringtonia* and *Careya* are for the most part considerable trees. The former frequenting low moist grounds, the latter preferring more elevated and dryer situations, but I have not been able to learn that the timber of any of them is held in esteem, by either the carpenter or ship-builder.

Remarks on Genera and Species. On the two genera which compose the Indian portion of this sub-order there is but little room for remark. One peculiarity however I have observed, namely, that the number of cells of the ovary differ not only in different species but occasionally in different specimens of the same plant. When variations, in this respect, occur, I have found them indicated by the calyx, the lobes of which correspond with the cells. *B. racemosa* has usually a two-lobed calyx, and the ovary is 2-celled,* but, sometimes, the calyx is three-lobed, and then I have found the ovary 3-celled. *B. acutangula* has a 4 lobed calyx and 4-celled ovary as Gærtner describes: hence the generic character is neither ovary 4-celled as Gærtner has it, nor 2-celled as Roxburgh, correcting Gærtner, says it should be; but, ovary

* After this was in type I had an opportunity of examining the ovary of *B. speciosa*, a species with a 2-lobed calyx, which I find 4-celled.

2 or 4-celled, sometimes but rarely 3-celled. I have from Ceylon what appears to be a small flowered variety of *B. acutangula*, it may however be a distinct species, but that, my specimens scarcely enable me to determine.

The number of cells of the ovary of *Careya*, like that of *Barringtonia*, seems to vary, as in the accompanying figure, which, though not prepared under my eye, I have every reason to believe a correct representation of the specimen, five are shown though four is the normal number.

EXPLANATION OF PLATES 99 & 100.

Careya Arborea, Roxb.—1. Flowering branch, slightly reduced, in size.
2-3. Fasciculi of stamens, back and front views.
4. Anthers, back and front views.
5. Ovary, cut vertically.
6. Ovary cut transversely, but showing 5 in place of 4-cells, the usual number.
7. A cluster of full grown fruit.
8. One of them cut transversely, showing the seed imbedded in soft, loose, cellular matter, which occupies the whole interior of the fruit.
9. A seed, detached.
10. The same cut transversely, the central dark spot representing the form and position of the embryo in the midst of a copious albumen.
11. The same, cut longitudinally—both from young specimens.
12 & 13. The same parts, as seen in ripe seed.

Sub-order Philadelpheæ.

Much difference of opinion seems to exist among Botanists as to the place this small tribe of plants should occupy in the Botanical system.

Jussieu originally referred them to *Myrtaceae*, Mr. D. Don, afterwards removed them thence and constituted them a distinct order, assigning as their nearest affinities *Saxifrageae*. DeCandolle so far adopted this view as to indicate *Hydrangeae*, a tribe of *Saxifrageae*, as their nearest allies, but notwithstanding, stations *Philadelpheae* next *Myrtaceae*: *Deutzia* however he gives to *Hydrangeae*. Lindley and Arnott both adopt the order, both place it near *Myrtaceae* and both differ from DeCandolle in considering *Deutzia* one of its genera. Bartling on the other hand takes a totally different view and places the genera referred here among his *Onagrariae*, a station, in my opinion, most erroneous since it virtually reduces that order, by depriving it of its only really good character, the binary arrangement of all its parts, "every part of the flower being some regular multiple of two" a most valuable character but lost on the union of *Philadelpheae* which have a quinary arrangement. *Deutzia*, referred here by Lindley, Arnott, and Meisner, is excluded by D.C. and Bartling. Meisner, differing from these leading authorities, reverts to Jussieu's arrangement and replaces, as I have here done, the tribe among *Myrtaceae*, raising it to the rank of a suborder. I have the more readily followed Meisner, partly because I do not clearly see on what point, with the exception of albuminous seed, a good distinction can be established, but principally, because it affords me a convenient opportunity of noticing an Indian order, which, from its being confined to the northern regions and not admitted into our Prodromus, would otherwise have been passed over.

Whether or not I am correct in considering this a sub-order rather than an order is a question which may be left for abler Botanists, and enjoying better opportunities for its examination, to determine. In the mean time, I copy Dr. Lindley's character of the order, as given in the second edition of his natural system.

"Calyx superior, with a persistent limb, having from 4 to 10-divisions. Petals alternate with the segments of the calyx, and equal to them in number, with a convolute-imbricate æstivation. Stamens indefinite, arising in 1 or 2 rows from the orifice of the calyx. Styles either distinct, or consolidated into one, stigmas several. Capsule half inferior, with from 4 to 10-cells, many-seeded. Seeds scobiform, subulate, smooth, heaped in the angles of the cells upon an angular placenta; aril? loose membranous. Albumen fleshy; embryo inverted, about as long as the albumen, cotyledons oval, obtuse, flattish; radicle longer than the cotyledons, superior, straight, obtuse. Shrubs. Leaves deciduous, opposite, toothed, without dots or stipules. Peduncles axillary or terminal, in trichotomous cymes. Flowers always white. Fruit sometimes a little scurfy."

ஆவீமாமரம்
Aveemah marrum }

CAREYA ARBOREA (ROXB.)

ஆயமரம்
Avamah murrum

CAREYA ARBOREA (ROXB.)

Affinities. Whether an order or sub-order this tribe certainly forms, through *Hydrangeae*, the connecting link between *Saxifrageae* and *Myrtaceae*, and seems even to render it probable that a more natural distribution would be, to unite *Hydrangeae* with *Philadelpheae*, and thus form an order intermediate but distinct from both. This, in fact, has already been partly accomplished by DeCandolle, who has placed *Deutzia* among his *Hydrangeae*, while all others, with one exception, place it in *Philadelpheae*. Bartling places it among his *genera incertae sedis*. This is merely thrown out as a suggestion not being myself in possession of materials to follow out the enquiry.

Geographical Distribution. *Deutzia* is found in Japan and India, *Decumaria* is an American genus, and *Philadelphus* is indigenous in Europe, America, and the north of India— Nothing seems to be known of their properties.

LXVI.—ONAGRARIÆ.

This, like the preceding, is an order on the limits of which Botanists seem greatly to differ in opinion; some, Brown, DeCandolle, &c., considering *Onagrariae* and *Halorageae* distinct orders, while others, Lindley and Meisner, view them as parts of one more extensive group, which they call Onagraciæ including, according to the former, (Lindley) as sub-orders—*Circeae*, *Hydrocaryes*, and *Halorageae*; to which Meisner adds, *Callitrichineae* and *Ceratophylleae*. But of these Lindley disposes very differently, by sending *Callitrichineae* as a distinct order to the imperfect flowered division of the system, while he views *Ceratophylleae* as a sub-order of *Urticeae*. Endlicher (genera plantarum) on the other hand retains both as distinct orders, placing them along with *Podostemmeae* near *Piperaceae*.

In the midst of these conflicting opinions I confess myself altogether incompetent to decide which is right, but will adopt a middle course. With this view I retain *Onagrariae* and *Halorageae* as distinct orders, but exclude *Callitrichineae* from the latter, as I formerly did *Ceratophylleae* from *Salicareae*, both to be afterwards considered along with *Podostemmeae*, specimens of a species of which I have received from both Ceylon and the Neilgherries, further, viewing the genera *Circæa* and *Trapa* as sufficiently distinct from all those of the true *Onagrariae* to warrant their partial separation, I shall follow Lindley in considering these as sub-orders.

Thus limited, this order includes only two genera from the south of India, *Jussiæa* and *Ludwigia*, though it is probable *Epilobium* will yet be added, as some species of it are found on the Himalayas, and I think I have seen one from Ceylon and another from the *Neilgherries*, but probably introduced.

Of *Circæa* I have one species from the Neilgherries and Pulney mountains. *Trapa* has been long known in India.

Most of the true *Onagrariae* are herbaceous plants or tender shrubs, with angular or round stems and opposite or alternate simple leaves, either sessile, or attenuated at the base into a short petiol, often dentate or serrated, but rarely pinnatifid, dotless and exstipulate. In the few met with in India they are quite entire. The flowers are bi-sexual, regular, axillary and solitary, or racemose and, with scarcely an exception, all the parts regular multiples of two, four being the prevalent number.

The following is Dr. Lindley's character of the order.

" Calyx superior, tubular, with the limb 4-lobed; the lobes cohering in various degrees, with a valvate æstivation. Petals generally equal in number to the lobes of the calyx, into the throat of which they are inserted, regular, with a twisted æstivation. Stamens four or eight inserted into the calyx: filaments distinct; pollen triangular, usually cohering by threads. Ovary of several cells, generally crowned by a disk; style filiform; stigma either capitate or 4-lobed. Fruit baccate or capsular, many-seeded, with 4 cells. Seeds numerous, without albumen; embryo straight; radicle long and taper; cotyledons very short. Herbaceous plants or shrubs. Leaves alternate or opposite, simple, entire or toothed. Flowers red, purple, white, blue, or yellow, axillary or terminal."

Affinities. In habit they are allied to *Salicareae*, from which they are distinguished by their ovary cohering with the tube of the calyx, not free as in them.

They also approach *Myrtaceae* through *Fuschia*, but differ in the absence of pellucid dots and in having definite stamens. This last character equally distinguishes them from *Philadelpheae.* The filiform style and absence of albumen separate them from *Halorageae*, from which they also differ in habit. They have also been compared with *Loaseae* but are readily distinguished by their binary, not quinary, arrangement of the parts of the flower which mark that order, leaving altogether out of consideration the acrid stinging properties possessed by *Loaseae.*

Geographical Distribution. The species of this order are numerous, amounting according to DeCandolle's Prodromus to 248, including *Trapa* and *Circæa*, the greater portion of which are American, though, to some extent, found in all countries from the extreme north, through every degree of latitude, to the equator, and thence nearly 50 degrees south, but most abound in the temperate regions. In India, within the tropics, the species are few and except *Ludwigia parviflora* and *Jussiœa repens*, of rather rare occurrence. In the more temperate regions of the Himalayas thirteen species of *Epilobium* have been found, one of which has been figured by Dr. Royle.

Properties and Uses. Of these almost nothing is known. The roots of the evening primrose *Ænothera biennis* are edible, and it is cultivated for their sake.

Remarks on Genera and Species. In an order containing only two genera within the limits to which this work extends, there is not much room for remark on this division of the subject, yet I cannot altogether pass it over, as I think we have more genera than we can find good characters for. *Jussiœa* is readily distinguished by having twice as many stamens as petals, but in both *Ludwigia* and *Isnardia* they are the same, and in truth, so far as I can discover, there is no good difference between these genera, the plant here figured, which is unquestionably a *Ludwigia,* seems to agree equally well with the character of *Isnardia.*

EXPLANATION OF PLATE 101.

Ludwigia parviflora.
1. Small plant—*natural size.*
2. Expanded flower.
3. Stamens.
4. Capsule cut transversely.
5. Ovary cut longitudinally.
6. Mature capsule splitting, showing the ripe seed.
7. Ovary cut transversely, 4-celled, with several rows of ovules in each—*all more or less magnified.*

Nos. 4 and 7, are misplaced.

Sub-order Circæeæ.

This sub-order consists of but one genus, essentially distinguished from all the true *Onagrariae* on the one side, by the cells of its ovary having only one ovule, and from *Hydrocaryes* on the other, by its ovules being erect not pendulous.

From *Halorageae* it is equally distinguished by its erect, not pendulous, ovules, and still further by its ex-albuminous seed. The following is Lindley's character of both the sub-order and genus.

" Calyx superior, deciduous, tubular, with a two-parted limb. Petals 2, alternate with the lobes of the calyx. Stamens 2, alternate with the petals, inserted into the calyx. Disk large, cup-shaped, filling up the whole of the tube of the calyx, and projecting beyond it. Ovary 2 (or 1) celled, with an erect ovule in each cell; style simple, arising out of the disk; stigma emarginate. Fruit 2 (or 1) celled, 2-valved, 2 (or 1) seeded. Seeds solitary, erect; albumen none; embryo erect; radicle short, inferior. Herbaceous plants. Leaves opposite, toothed, stalked. Flowers in terminal and lateral racemes, covered with uncinate hairs."

Affinities. These have been already pointed out under the preceding order.

Geographical Distribution. They have only been found in the northern hemisphere. The species though few in number, have a wide range over the northern regions of Europe, America and Asia—Royle has figured one from the Himalayas and I have one from both the

LUDWIGIA PARVIFLORA (ROXB.)

நெட்டிப்பூண்டு }
Natteepoondoo } Tam.

Rungia del. Colored by E.A.Rodrigues Winchester lith:

CIRCÆA ALPINA.

Neilgherry and Pulney mountains. Royle considers his a new species and has called it *C. cordata*, mine does not appear to differ specifically from *C. alpina*, either in character, habit, or in the kind of locality where it grows.

Remarks on Species. It is almost amusing to peruse the characters by which Botanists, ever since the days of Linnæus, have been endeavouring to distinguish between *C. lutetiana* and *C. alpina*, which neither individually nor collectively would, in any doubtful case, enable any one, except by chance, to tell the one from the other, even though the species are certainly distinct. The genus until extended by Indian additions consisted of those two species only, the fruit of the former of which is 2-celled, with an erect seed in each cell, hence the generic character " ovarium 2-celled with an erect ovulum in each cell: fruit 2-celled, 2-valved, 2-seeded. Such being the case in one species it is inferred it must equally be so in the other, and the flower being small and fruit rarely produced, this is taken for granted. By taking it for granted Botanists have puzzled themselves in vain, for at least a century, to find good specific characters by which to distinguish them. The ovary at once supplies the long sought-for desideratum.

Ovary 2-celled—*C. lutetiana.*

Ovary 1-celled—*C. alpina.*

EXPLANATION OF PLATE 101* OR 112.

Circæa alpina.
1. Plant—*natural size.*
2. A flower, front view.
3. Flower and ovary, side view.
4. Stamens.
5. Stigma.
6. Detached ovary.
7. Cut transversely.
8. Cut vertically, showing the erect ovule—*all more or less magnified.*

Sub-order Hydrocaryes.

This sub-order, like the last, consists of only one genus, *Trapa*, and differs essentially from it in the position of its ovules—erect in that, pendulous in this. They are floating plants, always found in water. The Indian species *T. bispinosa* is so very rare a plant, in southern India, that I have only once seen it growing and that on the Malabar Coast. The sub-order is thus characterized by Lindley.

" Calyx superior, 4-parted. Petals 4, arising from the throat of the calyx. Stamens 4, alternate with the last. Ovary 2-celled; ovules solitary, pendulous; style filiform, thickened at the base; stigma capitate. Fruit hard, indehiscent, 1-celled, 1-seeded, crowned by the indurated segments of the calyx. Seed solitary, large, pendulous; albumen none; cotyledons 2, very unequal. Floating plants. Lower leaves opposite, upper alternate; those under water cut into capillary segments; petioles tumid in the middle. Flowers small, axillary."

The species of this genus, 5 in number, are all natives of Europe and Asia, one is a native of Europe, 2 of India proper, one of China, and one of Cochin China.

Properties and Uses. " The great seeds of *Trapa* are sweet and eatable. Those of *T bispinosa* form an extensive article of cultivation in Cashmere and other parts of the east, where they are a common food, under the name of Singhara nuts."—Lindley.

LXVII.—HALORAGEÆ.

This is a small order of aquatic or sub-aquatic, herbaceous, very rarely suffruticose plants, but widely diffused, being found in every quarter of the globe. Their habit, generally, is so peculiar, that they were at one time even placed among monocotyledonous plants by some Botanists. Mr. Brown was the first to separate them as a distinct order and determine their affinities, so late as 1814. Since then all Botanists adopted his views until Dr. Lindley, in 1836, suggested that they might be reduced to a sub-order and ranged under *Onagrariae*, as mentioned under that order. In this view he has been followed by Meisner and not without some

show of reason, as the points of distinction between the two are few, and some of them I think unimportant. The principal are the absence of a style, the stigmas equaling the number of the cells of the ovary, sessile and pencillate or papulose, and lastly. the seed being albuminous and pendulous in place of exalbuminous and erect or ascending. Judging from analogy, the absence or presence of a style can be of but secondary importance, so also the character of the stigma whether capitate or divided. In *Trapa* the seed are equally pendulous, and some true *Halorageae* have a sparing albumen. For these reasons I should perhaps at this time have followed Lindley's view had we not already adopted the other in our Prodromus, and my departing from it here might tend to cause confusion.

The Indian species of this order, excluding *Callitrichineae,* all belong to the tribe or sub-order *Cercodeeæ* and are referable to three genera, *Haloragis*, *Myriophyllum,* and *Serpicula*, species of each of which are found on the Neilgherries. *Hippuris* a peculiarly northern genus, has not, so far as I am aware, been yet found in India. As in the Prodromus we have confined ourselves to giving the character of the tribe *Cercodeeæ*, I shall here give Lindley's character of the order, or, as he views it, sub-order.

" Calyx superior, with a minute limb, petals minute, inserted into the summit of the calyx, or wanting. Stamens inserted in the same place, equal in number to the petals, or occasionally fewer. Ovary adhering inseparably to the calyx, with 1 or more cells; style none; stigmas equal in number to the cells, papulose, or pencil-formed; ovules pendulous; albumen fleshy; embryo straight, in the axis; radicle superior, long and taper; cotyledons minute. Herbaceous plants, or under-shrubs, often growing in wet places. Leaves either alternate, opposite, or whorled. Flowers axillary, sessile, occasionally monœcious or diæcious."

Affinities. These have been already sufficiently explained.

Geographical Distribution. Europe, North America, Africa, India, China, Japan, New Holland, and South Sea Islands, all claim representatives of this order, though the whole number of species described by DeCandolle only amounts to 38, and probably at this time not more than 50 exist in herbaria, another instance of the often observed fact, that families of plants, peculiarly aquatic in their habits, have a wider diffusion, in proportion to the number of species, than others altogether terrestrial.

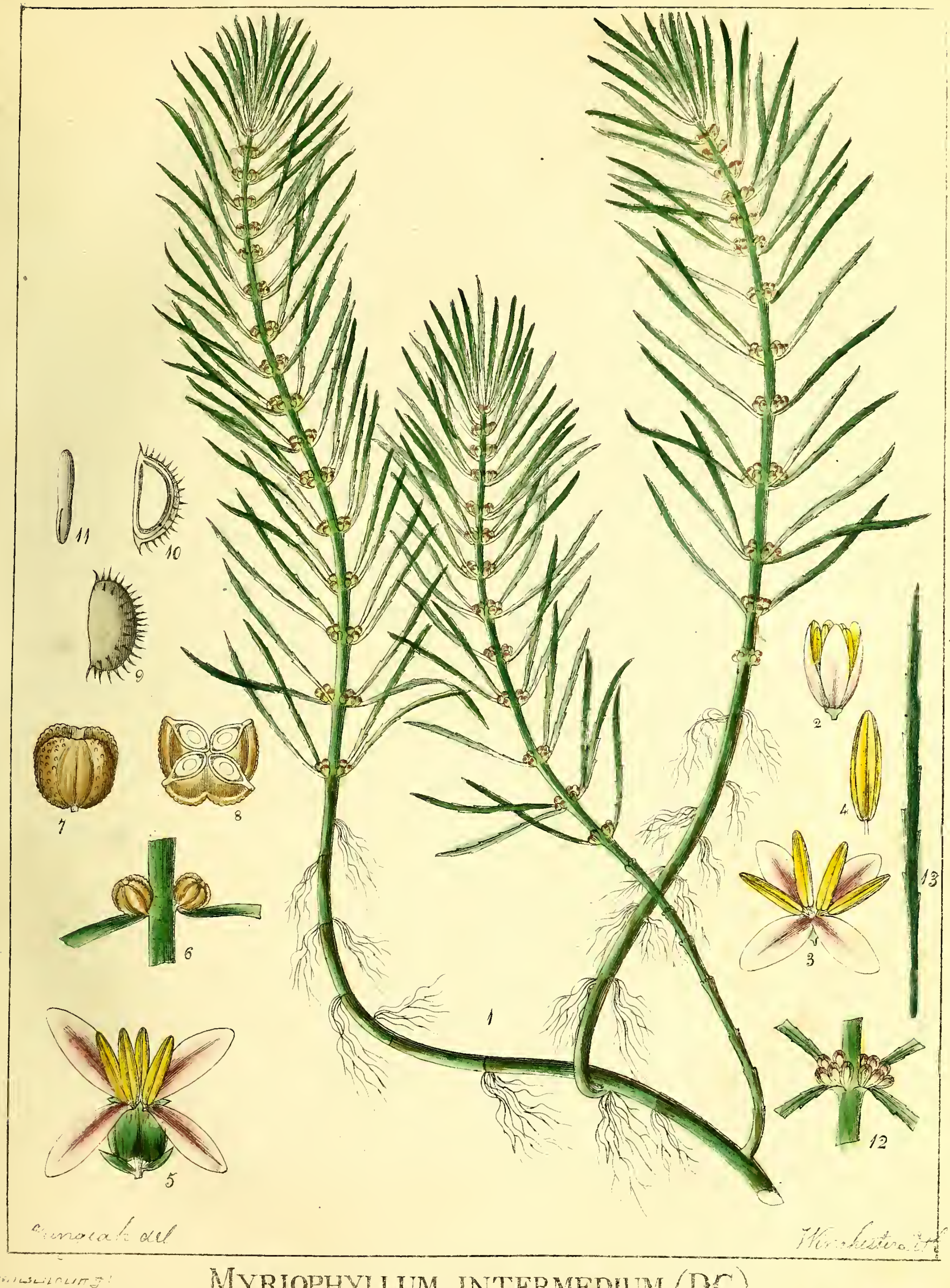
Properties and Uses. None of any importance have yet been discovered.

EXPLANATION OF PLATE 102.

Myriophyllum intermedium.
1. Flowering plant—*natural size.*
2. A male flower.
3. The same opened to show the insertion of the stamens.
4. A stamen.
5. A bisexual flower.
6. Fruit—*in situ.*
7. The same detached.
8. Cut transversely.
9. A detached carpel.
10. The same split open showing the pendulous seed.
11. Embryo detached from the albumen.
12. A cluster of flowers *in situ.*
13. A leaf—*all more or less magnified.*

LXVIII.—CUCURBITACEÆ.

A large, very natural and most important order, principally confined to the tropics and warmer regions of the earth. In this country some species so greatly abound that they are to be met with climbing in almost every hedge and thicket, others are equally frequent spreading over the surface of the ground. Those frequenting the former situations often attain so great a size as completely to cover large trees with their luxuriant foliage. This though a well known order and some of the species very extensively cultivated, is still far from being well understood, its structure and habits being so peculiar, that it is difficult to find any other with which to compare it, and learn, by analogy, its true relations in the vegetable kingdom. While the order thus stands almost alone, in a manner isolated in the system of plants, and its species can



MYRIOPHYLLUM INTERMEDIUM (D.C.)

scarcely be confounded with any other, except perhaps *Passifloreæ*, there is not one where the difficulty of assigning definite limits to either genera or species is more felt.

Deferring to their proper place, all remarks on the genera and organs from which the characters are taken, I may observe here, that the discrimination of the species is most difficult, as no dependence can be placed on the form of the foliage as affording specific characters, almost every variation of form from simple, up to much divided leaves, being found in the same species and even occasionally on the same plant. Nearly all are annuals, with climbing succulent stems furnished with tendrils, supposed to be abortive lateral stipules, or according to modern Botanical doctrines transformed leaves, stipules being considered modified leaves. The flowers are usually unisexual, the male and female generally on the same plant or even springing from the same axil; more rarely they are on different plants as in the example given, (*Trichosanthus palmata*), usually the flowers are white, red or yellow. The coloured portion of the flower is supposed by some Botanists to be a petaloid calyx, and the apparent calyx, merely certain external appendages, a view not likely to find many proselytes. The stamens in this order are peculiar and present many variations of form. These have recently been employed to supply sectional characters for the distribution and more easy definition of genera. The fruit, like every other part of these singular plants, is quite *sui generis* and is in consequence designated by its own name, *Pepo* or *peponida*, whence *Peponiferæ* the name given by Bartling and Endlicher to the class. A true pepo is, as I have recently shown, (Madras Journal of Science) a tri-carpillary fruit but with the carpels inverted: that is with the dorsum of the carpellary leaf in the axis, and the placentiferous margins turned towards the circumference; instead of, as usual with other fruits, towards the axis. Differences so great, in the construction of this most essential organ, mark this as a peculiar order, the affinities of which have still to be discovered.

These rather extended introductory remarks I have felt to be necessary to facilitate the right understanding of this very difficult and curious order.

"Calyx 5-toothed, sometimes obsolete. Petals 5, distinct or more or less united, sometimes scarcely distinguishable from the calyx, strongly marked with reticulating veins, sometimes fringed. Stamens 5, distinct or triadelphous: anthers 2-celled (or rarely 1-celled), usually long, and sinuous, rarely ovate. Ovarium adhering to the tube of the calyx, of 2 or 3 carpels. Carpels inverted, that is, having the dorsum in the axis and placentiferous margins in the circumference, hence the fruit 2-3 celled but with 4 or 6 parietal placentas! ovules solitary or indefinite, imbedded in pulp: style short; stigmas 2 or 3, 2-lobed, very thick, velvety or fringed. Fruit fleshy, usually a peponida. Seeds usually ovate and compressed, enveloped in a juicy, or dry and membranous, arillus: testa coriaceous, often thick at the margin. Albumen, none. Embryo straight: radicle next the hilum: cotyledons foliaceous, palmatinerved. Stem succulent; climbing by means of tendrils usually lateral, and formed of abortive stipules. Leaves palmatinerved, alternate. Flowers unisexual"

Affinities. These are not by any means clearly understood. Hitherto *Cucurbitaceae* have been, by the almost universal consent of Botanists, arranged among orders with one-celled ovaria and parietal placentas, a place they can no longer be allowed to occupy if the above explanation of the formation of a pepo be found correct, since in it, we have a peculiarity of structure by which this family is widely separated from every other known order of the vegetable kingdom. Lindley places them in his Epigynous group, among a suit of orders all having a central placentæ, but distinguishing the *Cucurbital alliance* by the character "Placentæ parietal" and remarks, in another place they are so closely allied to *Passiflore* "that they scarcely differ except in their sinuous stamens, unisexual flowers and exalbuminous seed." Endlicher places them between two parietal groups, associating with them another very curious family, *Begoniaceæ*, the affinities of which, if his view is correct, must up to this time have been totally misunderstood. The very intimate union of the calyx and corolla, which led Jussieu to view the flower as apetalous, and range the order under his class *Apetalæ*, is a point of structure which cannot be overlooked in determining its affinities; for, though I think Jussieu's view on this point essentially incorrect, yet, it has had the effect of pointing out a relationship with *Euphorbiaceae*, in some points striking, but which might otherwise have been overlooked. As an order the *Cu-*

curbitaceae, are distinguished from all others by their stamens, but more especially the anthers, the cells of which, in most of the order, are very long, winding upwards and downwards on the exterior surface of the connectivum. This structure of the anther, combined with the very remarkable one of the ovary and fruit, added to the habit of the plants and lateral tendrils, widely separate this from every other order in the vegetable kingdom. Various attempts have, however, been made to find associates near which to place them in the system of plants. Of the orders thus selected, as relations, some have superior some inferior fruit, some albumenous some exalbumenous seed, but all, except Lindley's group of *Epigynosæ,* among which he places it are objectionable on account of their one-celled ovary: but, as a set off against this advantage he constructs his *Cucurbital alliance* of plants, having Parietal placentæ which properly speaking, excludes *Cucurbitaceæ.* This group, however, remodeling the alliance will, I apprehend, be found upon the whole the best place, as agreeing with their general character "ovary inferior usually having an epigynous disk" but upon no other account, as in truth they have no relations here. The term *Peponiferae* under which Meisner groups 9, and Bartling 8 orders is most incorrect as being only applicable to one member of the group.

Geographical Distribution. This family though essentially a tropical one and of more frequent occurrence in India than in any other country, has, yet a wide distribution over the world, a few being found even so far north as Europe and one in Britain. At the Cape, we learn from Harvey's "Genera of South African plants" that there are species referable to seven different genera: one species is found in Norfolk island: but generally they are rare in Australia. In equinoctial America and Africa they are of more frequent occurrence, but no where so abundant as in India and her islands, extending eastward to China and Japan. Blume enumerates 46 species found by him in Java alone, which leads one to the inference that the rest of Asia will be found to produce at least two or thre times as many more. M. Seringe however only assigns 70 to all Asia including Java, which single fact, shows how little this family is known. Since more than half of the whole number are from that small portion. Let us hope this statement, added to the increasing facilities, which our improved knowledge of their structure confers, in the determination of species, may lead to greater attention being directed to their elucidation, which will unquestionably repay the enquirer with a rich harvest of interesting discoveries.

Properties and Uses. These are varied. Acrimony and a drastic tendency pervade many species, the fruit of some of which afford cathartics of remarkable power, acting, in even small doses, with great energy on nearly the whole line of the alimentary canal.

Generally speaking, however, this intensity of power is of rare occurrence though the property is found more or less active in every part of the plant; mildly in the roots of some and the leaves and young shoots of others, but in greatest intensity in the pulp surrounding the seed. The seed themselves do not partake of that property, being in nearly all, mild and oily. There is reason to believe that some at least, if not all the edible sorts, owe their freedom from this property to cultivation, as some of them in the wild state are found to possess it in great intensity. The *Lagenarea vulgaris* or bottle gourd may be cited as an example, it being recorded that some sailors were poisoned by drinking beer that had been standing in a flask made of one of these gourds: and Dr. Royle mentions a somewhat similar case, where symptoms of cholera were induced by eating the bitter pulp. The fruit of many of the species of *Cucumis,* the genus to which the Melon and Cucumber belong, are powerfully cathartic, among these *C. Hardwickii,* Royle and *C. psudo colocynthes* Royle, may be enumerated as the chief, but even the Cucumber, especially the less highly cultivated varieties of this country, are sometimes known to prove strongly aperient in susceptible constitutions. *C. colocynthes* (now *Citrullus)* is necessarily removed from the genus but affords one of the most valuable medicinal agents derived from the order.

The Melon, *C. melo,* and *C. utilissimus,* so far as I have been able to learn are free from it. The fruit of some species of *Luffa* are violently cathartic such as *L. amara* and *L. Bindaal* of Roxburgh, while those of *L. acutangula* (*Cucumis acutangulus* Ainslie) are a favourite pot-herb of the natives, and esteemed very wholesome. Some of the species of *Bryonia* especially *B. alba* and *B. dioica* partake of the cathartic properties of the family in great intensity.

Curiously enough it is said that the juice of the root is strongly cathartic, and is often employed as such, while the young shoots are so free from the property that they are used as a pot herb and said greatly to resemble asparagus in flavour. The purgative properties of the root have been long known and in the opinion of some modern writers have fallen into unmerited neglect, as being fully equal in power, even when dried and powdered, to Jalap and when recent much more so. But of all those yet mentioned none approach the *Elaterium* in the concentrated virulence of this quality; a few grains of the pulp being known occasionally to bring on symptoms of poisoning, and a case is recorded by Dr. Christison where a person after carrying a specimen in his hat was attacked with headache succeeded by colic pains and frequent bilious vomiting and purging.

Such being the predominating quality of the family, it is well to be cautious in the use of even the best known—many however are in use as pot herbs, among these may be mentioned with just encomiums the red gourd *Cucurbita maxima* (*C. hispeda* Ainslie) the flesh of which when boiled somewhat resembles in taste a fine tender carrot. The water melon *Cucurbita citrullus* so highly esteemed for the cool refreshing juice of its large fruit. The white gourd (*Benincasa cerifera* or *Cucurbita pepo*) which Ainslie informs us (under *Cucurbita hispida*) is presented at every native marriage feast, being supposed to ensure prosperity to the wedded pair. The vegetable marrow (*Cucumis ovifera*) justly esteemed one of our finest culinary vegetables; and a few others.

All the numerous cultivated varieties of the melon and cucumber are known to be wholesome. Some, if not all the Indian species of *Momordica*, seem equally safe. The fruit of several species of *Trichosanthes* especially, those of *T. anguina* are in daily use, even among Europeans, dressed in curries; but those of *T. palmata* are not used and are considered poisonous by the natives. Those of our *Coccinia indica*, (*Momordica monadelpha*, Roxb.) so common in every hedge, is eat by the natives in their curries and when fully ripe, (quite red and pulpy) seem to afford a favourite repast to many birds. Notwithstanding the drawbacks mentioned above, this is certainly a most useful family of plants, owing to the great size of their fruit and the large quantity of nutritious matter which the edible sorts afford, and which, on that account, are largely cultivated in every part of India. Those unfit for food, supply many useful medicines, but even the best known, ought to be used cautiously when not ameliorated in their qualities by cultivation.

Remarks on the Genera and Species. This being a family not yet well understood, the limits of the genera are consequently imperfectly determined, whence, in the opinion of some Botanists, several very unsuitable combinations of species are met with among them. This seems probable enough, but is an error not easily avoided in families so natural, unless we are very careful in the selection of our characters, and attentive not to introduce anything extraneous, by the employment of characters derived from organs apt to vary in their forms, for, while they appear to give greater precision, they actually weaken the definition, or may even render it altogether useless. M. Serenge for example (D.C. Prod.) employs the relative size and shape of the calyx segments as generic characters, parts in themselves liable to vary, even in the same species, both in size and shape, therefore quite unfit to enter into a generic character, and when so employed are liable either to mislead or to constitute very artificial genera, and, what I consider still more objectionable, he constitutes one genus on account of its male flowers being furnished with a large bractea, but excludes from it *Trichosanthes palmata*, the bracteæ of which are equally conspicuous.

The order is divided into two tribes of very unequal magnitude, the one, *Nhandirobeae*, containing only two genera and very few species, the other *Cucurbiteae*, to which Meisner assigns 35, but which are reduced by Endlicher to 28 genera.

The first of these tribes *Nhandirobeae*, has by Endlicher been raised to the rank of an order. Whether in this view, he is correct I am unable to say, as I have not a female flower wherewith to examine the ovary, on the structure of which, as compared with that of true *Cucurbitaceae*, the decision of the question must mainly depend. If the carpels are similarly inverted in both, which the section of the fruit in the accompanying figure seems to indicate, then, I think it may very well be retained in its present position or at most removed as a sub-

order: if different, that is, if the placenta are, in the usual acceptation of the term, truly parietal, then it ought undoubtedly to be removed and placed near if not atcually united with *Passifloreae*. But in either case, the points of difference, between *Nhandirobeae* and *Cucurbiteae*, seem quite sufficient to distinguish them as separate orders, should that be deemed a judicious arrangement, which is not improbable, were it only for the purpose of simplifying the ordinal character.

Its claims to rank as a sub-order of *Cucurbitaceae* may be at once admitted, supposing the carpellary structure the same, on account of the differences in the flowers and anthers which are very distinct in the two tribes and by *Nhandirobeae* having axillary not lateral tendrils.

Two genera only are assigned to this tribe or order—*Zanonia*, (Plate 103), and *Fevellea*. The first of these, so far as yet known are altogether of Asiatic origin and extends from Malabar eastwards as far as Java, where Blume found 2 species. The other, which until lately, were only known as natives of America, have recently been found in Assam, whence I have, through the kindness of Captain Jenkins, received two species, but unfortunately the male flowers only.

The 35 genera of *Cucurbitaceae*, Meisner in his table, distributes according to the stamens into two leading sections—A—stamens free—B—stamens variously united among themselves. To the first of these sections he refers only two Indian genera *Luffa* and *Citrullus*, others have since been added. To the other, ten are assigned. They are further distributed according to the number and mode of union of the stamens—the petals free or united, the anthers whether connate or distinct, the cells regular or bent and anfractuose, &c.

Since the publication of this tabular arrangement of the genera, Schrader, a German Botanist, has published a revised distribution of them, founded on a minute examination of a large proportion of the order, establishing his arrangement of the genera according to characters taken principally from the male flowers. The original memoir, published in a German periodical (Linnæa vol. 12), I have not yet seen, but Dr. Arnott obligingly prepared for my use a conspectus of all the genera of that memoir, adding several new ones of his own. This he has permitted me to publish should I think it desirable

Having satisfied myself, by the examination of several of the sections and genera, of the correctness generally of the characters and the facility of applying them in practice, as well as of the greater precision which their adoption confers on our generic characters, I can have no hesitation in subjoining this Conspectus and recommending, to careful examination, the principles on which it proposes to construct the genera of this very obscure and difficult order, as, I think, with some slight modifications it will be found to merit general adoption. Until, however, I have had more extended opportunities of doing so with recent specimens I refrain from saying more in its favour.

The characters of the tribes were not given, which is of little consequence as the tribe *Cucurbiteae* is, with a single exception, the only one found in India and the whole of the genera of this tribe are given, whether Indian or not, to enable those who may give their attention to this investigation, to determine genera not hitherto introduced into the Indian Catalogue. It may be necessary here to observe, that the fruit, in those genera said to have it baccate, is not truly a bacca, but only a slight modification of the *peponida*, the placenta being only apparently, not truly parietal, as in the true bacca.

The following explanatory extracts from the letter which accompanied the Conspectus, may not inappropriately be introduced.

" I have lately been revising our East Indian *Cucurbitaceae*, in consequence of Schrader's paper in the Linnæa, vol. 12. At first I was inclined to consider it worse than useless to subdivide old genera, especially *Bryonia*, as he has done: but when I came to consider his sectional characters, and that the form and position of the stamens and anthers and stigma and fruit are, really, the only characters hitherto employed for genera by other Botanists; and that all Schrader has done, is to keep only those species in their old genera that agree with the character and turning out, and making new genera of those that do not, then I felt inclined to go great lengths towards adopting his views. I intend here to give you a Conspectus, or abridged generic characters, which I have drawn up, not only for the Indian, but also for those

of the whole world, which I shall not object to your publishing as abridged characters of the genera of the tribe *Cucurbiteae* of Schrader."

At the conclusion of the conspectus he continues,—" These seem to be all the genera known, that truly belong to *Cucurbiteae,* they have all unisexual flowers. *Gronovia* has them bisexual, but is otherwise very closely allied. *Allacia* cannot be of this order, unless we suppose the description quite erroneous ; and if so, Loureiro may have had before him, in part at least, the *Telfairia pedata ; Myrianthus* cannot belong to *Cucurbitaceae. Thladianthus Runge* is imperfectly described as to the stamens, but may perhaps form a 7th tribe.

" I have laboured under great difficulty in making out these characters, partly because the published descriptions were very imperfect, partly because I had not several of the genera, and partly, from the extreme difficulty of examining the anthers after being dried and pressed. I would therefore suggest to you and other Indian botanists, to re-examine all the Indian ones on living plants, and have drawings made, paying particular attention to the representation of the anthers.

" At first you may, as I did, confuse section 7 with section 9, but if you will compare the flower of *Citrullus, Momordica* or *Lagenarea* with *Cucurbita* or *Coccinia,* you will readily see the difference. In section 7, the connectivum is lobed, and the anther cells are placed along the edge of the lobes—in sections 3 and 9 the connectivum is not itself lobed, but the anther cell is bent," (it winds upwards and downwards along the back of the connectivum).

Warned by the concluding paragraph of the difficulty attending the description of these plants from dried specimens, I took occasion, as opportunity offered, to compare some of the sectional characters with recent specimens, and feel disposed to think the sections too numerous, and not sufficiently distinguished. I have not yet succeeded in comparing the whole, but would suggest the following alterations, which I think would improve the arrangement.

Section 6 might with advantage be suppressed, and its only genus referred to section 5. Sections 7 and 9 would be better united, the anthers being the same in both ; transferring, however, *Cucurbita* to section 8, on account of the anthers,which are similar to those of *Trichosanthes,* making the insertion of the filaments a matter of secondary consideration, a generic not a sectional distinction.

The difference between sections 7 and 8 would then be—not that in the former the anther is lobed and in the other entire, but that in section 7 the back is traversed by an elevated gyrose ridge, on the top of which the long gyrose anther cell is placed, while in section 8 there is no such elevation. the anther cell being sunk into the substance of the connectivum, not elevated on a ridge with a deep furrow between each bend. To this may be added that the connectiva in section 8 is elongated ; hence, from the union of the three, a cylinder results, while in the other their union produces a sort of capitulum.

Bryonia Garcini, doubtfully referred to *Bryonia,* is a new species of *Pylogyne* : *Bryonia leiosperma,* I find, from the examination of dried specimens, is a second species of *Mukia,* with which it agrees well in habit.

Notwithstanding these differences of opinion, it is not my intention to alter the conspectus, but print it simply as it reached me, the few additions I have to make, being included within brackets—thus [ ]. Before proceeding further it may be well to explain what is meant by the term tri-adelphous, as applied to this family, which is of such frequent occurrence in the following characters. The normal structure of *Cucurbitaceae* is to have five stamens, in place of which we usually find only three ; but when these are carefully examined it appears that two of them are twice the size of the third, and are actually made up of two united : each set is then called an adelphi or brotherhood, and the three together tri-adelphous. This structure is readily seen in the *Pekunkie (Cucumis acutangulus,* Ainslie) where the anthers do not cohere. In those where they do cohere it is not so clearly seen, as they then require to be separated artificially before it can be made out.

In some genera the anthers are described as being one or two-celled ; these characters require to be used with caution, as being generally of very difficult application in practice. Theoretically every anther is two-celled, and here in examining a number of instances with particular care, under a high magnifier, I have found most of them actually two-celled, though on less careful examination they appeared only one celled. If such is the case when examined with fresh specimens, how much more liable to error must we be when working with dried ones.

CONSPECTUS OR ABRIDGED CHARACTERS OF THE GENERA OF THE TRIBE CUCURBITEÆ* OF SCHRADER.

§ 1.—*Filaments 5, inserted on the throat of the corolla; anthers distinct or 3-adelphous, anticous, straight; fruit, —— baccate, few seeded.*

1. Coniandra (Schrad.) Corolla 5-partite: connectiva conniving, oblong, conical: fruit beaked. *South Africa.*
2. Cyrtonema (Schrad.) Limb of corolla 5-partite: filaments 5, incurved, connectiva incrassated 3-adelphous; anthers fixed laterally under the apex. *South Africa.*

§ 2.—*Filaments di or tri-adelphous, inserted on the tube of the corolla; anthers lateral, straight, 2-3-adelphous.*

3. Sicydium (Schlecht.) Corolla 5-petaled, petals undivided: filaments 3-adelphous, dilated and incurved at the apex; anthers without a beak. *Mexico.*
4. Bryonopsis (Arn.) Corolla 5-partite, lobes obovate, entire, undulated: filaments 3-adelphous, inserted on the throat, straight; anthers pointless: stigma fringed: berry few seeded. *East Indies—Courtallum.*
5. Achmandra (Arn.) Lobes of the corolla undivided: filaments tri-adelphous very short; anthers anticous, inserted along the margins of the connectivum, linear obloug; connectivum prolonged into a short beak beyond the anther: fruit baccate (always?) beaked. *East Indies. Bryonia epigæa, rostrata, deltoidea, and an undescribed species from Malabar.*

Obs.—Perhaps this and the two last genera might be joined to Melothria.
6. Melothria (Linn.) Lobes of the corolla undivided, denticulated: filaments 3-adelphous; connectivum pointless: fruit baccate, not beaked. *America.*

Obs.—Schrader notices an East Indian one, but that may perhaps be an *Achmandra.*
7. Ceratosanthes (Schrad.) Lobes of the corolla linear bifid: filaments 3-adelphous. *America.*
8. Anguria (Linn.) Lobes of the corolla entire: stamens diadelphous: fruit somewhat 4-angled. *America.*

§ 3.—*Filaments 3-adelphous inserted on the top of the tube, anthers all cohering by means of their connectiva, and applied at the back along the margins of the connectiva, sigmoid.* (?) two-celled.

9. Schizostigma (Arn.) Style simple, stigma peltate, fleshy, cleft into 10-12 radiating linear lobes. *Andes of Mendosa.* (*Cucurbita asperata.* Gill.)

§ 4.—*Filaments distinct or tri-adelphous. inserted on the throat of the corolla, anthers 6 or 3-adelphous, gyrose, anticous.*

10. Sphenanthe (Schrad.) *Mexico.*

§ 5.—*Filaments tri-adelphous, inserted at the base of the corolla, anthers lateral, straight, 3-adelphous.*

11. Pilogyne (Schrad.) Calyx campanulate; segments of the corolla patent, much longer than the calyx: anthers one-celled: style entire; stigma 1, pileate: fruit baccate, few seeded, obtuse. *South Africa.* [*East Indies—Bryonia Garcini?*]
12. Zehneria (Endl.?) Lobes of the corolla quite entire: style trifid; stigmas 3, flabelliform, quite entire: fruit baccate, few seeded, blunt. *South Africa, East Indies* and? *Norfolk Island.—Bryonia Mysorenses. B. Hookeriana.*
Perhaps this is only a subgenus of *Pilogyne.*
13. Karivia (Arn.) Calyx urceolate, corolla scarcely exserted, lobes minute, quite entire; anthers 2-celled; style entire; stigma pileate, 3-fid: fruit a peponida, many seeded, blunt or with a short thick beak. *East Indies, Bryonia umbellata. B. amplexicaulis.*
14. Rhynchocarpa (Schrad.) Lobes of the corolla denticulate, ciliated; style trifid; stigmas 3, jagged and toothed: fruit with a long slender beak. *Guinea.*

§ 6.—*Filaments tri-adelphous, inserted at the base of the corolla, anthers all cohering, posticous, linear, straight.*

15. Mukia (Arn.) Style entire, stigmas 3, more or less cohering, erect. Anthers distinct, one-celled, lateral; [connectivum prolonged, forming a projecting point: a globose abortive ovary in the bottom of the calyx.] *East Indies—Bryonia scabrella.* [*B. leiosperma.*]

§ 7.—*Filaments 5, or tri-adelphous, inserted at the base of the corolla; connectiva toothed or lobed, anthers applied at the back along the margins of the connectivum, and therefore flexuose, gyrose, or anfractuose.*

16. Bryonia (Linn.) Corolla 5-cleft: anthers tri-adelphous, one-celled: style trifid; stigmas subreniform or bifid: fruit ovoid or globose, baccate; few seeded. *Europe* and *East Indies—B. laciniosa*, India. *B. alba. B. dioica*, Europe. Perhaps also *B. Garcini* and *leiosperma*, but of these I have no male flowers by me to examine [*B. Garcini.* Stamens tri-adelphous one-celled: cells linear, marginal, not sigmoid, style one, stigma dilated, peltate: ovary few seeded; pepo inverse reniform, 2 seeded. This is probably a new genus, but if not seems to belong to *Pilogyne* rather than any other here. It cannot possibly belong to *Bryonia.*]
In the European plants, the type of the genus, there are two ovules in each of the 3 cells of the ovary—nearly all Blume's species belong to other genera.
17. Citrullus. (Schrad.) Corolla persistent, 5-parted, subrotate: anthers tri-adelphous, bilocular: style 3-fid; stigma obcordate, convex: fruit a fleshy or dry and fibrous, many-seeded peponida. *Africa, East Indies. Cucurbita citrullus* and *Cucumis colocynthis.*
18. Ecbaliam (Rich.) Corolla 5 cleft: anthers tri-adelphous: ovules in two rows in each cell; stigmas three, two horned: fruit an elastically and irregularly bursting peponida. *Europe—Momordica elaterium.*
19. Momordica (Linn.) Petals 5, adnate to the base of the calyx, deciduous: anthers all cohering: ovules

* This tribe contains all the East Indian genera except *Zanonica*—Schrader refers *Erythropalum* of Blume to Cucurbiteæ but that genus is very closely allied to *Mackaya* (Arnott in Jardine's Mag. of Zool. and Bot. vol. 2), and does not belong to the order.

ZANONIA INDICA (LINN.)

in a single* row in each cell; stigma two lobed; fruit a capsular, elastically bursting, 3 valved peponida. *E. Indies*, *South Africa* and *America.*

[* This though practically correct is not theoretically so, the carpellary structure being the same here as in others; each margin has its placenta and ovules: and though at any one section only one row appears, we do not find the ovules always attached to the same line of placenta on slicing the ovary successively from end to end but sometimes on the one, sometimes on the other side of the cell; such at least I find it in *Momordica Charantia.*]

To this genus seems to belong, *Muricia*, Loureiro and *Neurospermum*, Raf.

20. Luffa (Cav.) Petals 5, inserted in the base of the calyx, deciduous: anthers all distinct or di-triadelphous: style 3 fid; stigma reniform or bipartite: fruit a peponida, at length dry and internally fibrous, usually opening by a terminal lid, rarely indehiscent. *East Indies* and *Arabia.* There are 3 sections of this genus.

1st. Stamens distinct, *Luffa pentandra*, *acutangula*, and *Kleinii.*

2d. Stamens 3-adelphous. *L. amara*, Roxb. and nearly all the species of *Turia*, Forsk.

3d. Stamens di-adelphous—*L. tuberosa*, Roxb.

21. Benincasa (Sav.) Corolla (yellow), five-parted, patent: anthers 3-adelphous: style undivided, very short; stigma large, thick, irregularly lobed and plaited: peponida, fleshy indehiscent. *Asia.*

22. Lagenaria (Ser.) Corolla (white) five petaled: anthers 3-adelphous: style almost none; stigmas 3, thick and 2-lobed: peponida fleshy and indehiscent. *India*, *South Africa.*

§ 8.—*Filaments, 3-adelphous, inserted on the tube of the corolla; connectiva entire, anthers 3 or mon-adelphous, posticous, linear, bent upwards and downwards: calyx long, tubular.*

23. Trichosanthes (Linn.) Segments of the corolla lacerated and fringed: anthers 3-adelphous? or all united: style trifid; stigmas oblong, subulate: fruit a peponida, many seeded. *E. Indies.*

I reunite *Involucrarea* to tbis as a mere section depending on the bracteas, the character taken from the anther not holding good, at least *T. Cucumerina* has frequently the anthers all united, and I suspect also *T. anguina;* perhaps they only become tri-adelphous after fecundating.

[In all the species I have had an opportunity of carefully examining, the antbers are monadelphous or united. The style is not trifid, nor properly speaking the stigmas subulate, as they cohere nearly to the apex by their central face, though the stigmatic surface extends for some distance outwardly, and presents a somewhat subulate outline.

In *T. anguina* they are never tri-adelphous, the anthers cohere to the last as represented in the accompanying figure. This last species with *T. globosa*, and *trifoliata*, Blume, and *Involucrarea*, Serange (*T. Wallichiana*) form a very characteristic section, perhaps a subgenus, distinguished by their curiously bracteated male flowers]. R. W.

24. Gymnopetalum (Arn.) Calyx constricted at the mouth; corolla (yellow) 5-parted; segments quite entire: anthers all closely cohering: fruit baccate, ovate, beaked, few-seeded: seeds large, roundish, with a blunt margin *E. Indies.* There are two species—

1. *G. Ceylanicum* (Arn.) Leaves deeply 5-lobed; perianth glabrous: *Bryonia tubiflora* W. and A.

2. *G. Wightii* (Arn.) Leaves 3-5-angle-lobed; perianth hairy. *Courtallum.*

§ 9.—*Filaments usually tri-adelphous, inserted at the base of the perianth; connectiva entire, unless when produced into appendages beyond the anthers: anthers linear, posticous, bent upwards and downwards (calyx campanulate or rarely infundibuliform.)*

25. Cucumis (Linn.) Corolla 5-parted: anthers triadelphous, or all of them slightly cohering, with appendages at the apex! Peponida fleshy, indehiscent, or rarely irregularly dehiscent, polyspermous: seeds ovate, compressed, sharp edged. *Asia*, *Africa* and *America.*

26. Cucurbita (Linn.) Corolla campanulate, 5-cleft: filaments tri-adelphous at the base or quite monadelphous; anthers all cohering, without appendages: peponida fleshy, indehiscent, polyspermous: seed with a slightly thickened edge. *Asia* and *America.*

27. Elaterium (Lin.) Petals scarcely united at the base: filaments monadelphous, anthers all cohering: style thick; stigma capitate: fruit a coriaceous, one-celled, few seeded capsule, bursting elastically by two or tbree valves. *America.*

28. Schizocarpum (Schlch.) Corolla infundibuliform, quite entire: filaments 3-adelphous: anthers all cohering; peponida many seeded, bursting by several valves that cohere by their apex. *Mexico.*

29. Coccinea (W. and A.) Corolla campanulate, segments acuminated: filaments monadelphous, anthers tri-adelphous, conniving, without appendages: peponida somewhat baccate, many-seeded. [Usually of an oblong oval shape and bright red when ripe.] *East Indies.*

§ 10.—*Filaments monadelphous, connate into a column, which is capitate at the apex, and then bearing the gyrose posticous anthers.*

30. Cephalandra (Schrad.) *South Africa.*

EXPLANATION OF PLATE 103.

Zanonia indica.

1. Flowering branch (male plant) *natural size.*
2. Male flower, the petals removed, showing the 3-lobed calyx and insertion of the anthers.
3. An expanded flower showing the petals and stamens.
4. Corolla and calyx detached, the stamens more highly *magnified*, to show the form of the anther.
5. A fruit cut transversely.
6. A seed.

For this figure and dissection the draftsman is wholely responsible. It was executed while I was in England, and I have had no opportunity of comparing it with living plants to ascertain its accuracy. I suspect however there is an error in making it a monœcious plant.

EXPLANATION OF PLATE 104.

Trichosanthes palmata.

1. Flowering branch of the male plant, *natural size.*
2. A flower split open to show the insertion of the stamens.
3. Stamens detached.

4-5. The same split open, showing the long cells of the anthers, winding upwards and downwards on the back of the connectivum.
6. The staminal column cut transversely, showing the anthers one-celled.

EXPLANATION OF PLATE 105.

Trichosanthes palmata.

1. Flowering branch of the female plant.
2. A flower split open showing 4 sterile anthers. This number is not uniform.
3. Ovary, style and stigma.
4. Ovary cut vertically, through some oversight the more important transverse section is not given.
5. A mature fruit, *natural size.*
6. The same cut transversely, showing that the placenta at this period contract adhesions to the parietes, which is not the case at first.
7. A seed with its pulp.
8. The pulp removed.
9. The same cut transversely.
10. A cotyledon with its minute radicle.
11. The detached radicle and plumula. I fear this last figure is not quite correct.

EXPLANATION OF PLATE 105* OR 121.

Obs.—This plate was prepared long after the others which will account for the error in the numbering. The object of it is to illustrate my remarks on some of the sections of Dr. Arnott's Conspectus.

Cucurbita maxima.

1. Female flower the corolla removed, showing the ovary, style, stigmas and disk.
2. Male flower corolla removed, showing the calyx and stamens, anthers like those of *Trichosanthes.*
3. Detached stamens.
4. Female disk, the style removed to show the sterile gland-like anthers.
5. Ovary cut transversely, showing the inverted carpels with the aid of colouring a little more distinctly than in nature.
6. The ovary cut vertically.

Coccinea indica.

1. Female flower.
2. Male flower, corolla and calyx removed to show the stamens which correspond in form with the accompanying figures of section 7, but not with *Cucurbita.*
3. Style and stigmas.
4. Ovary cut vertically.
5. Cut transversely. The carpillary lines though apparently single, are actually double and do not cohere in the very early stages of the ovary.
6. A full grown fruit reduced in size.
7. The same cut transversely, showing the changes it undergoes in its progress towards maturity.
8. A seed.
9. The same slightly *magnified.*
10. (By mistake 16) a cotyledon showing the radicle at the base.
11. A seed, testa removed showing the naked cotyledons.

Momordica charantia.

1. Male flower and a detached petal, showing the stamens *in situ.*
2. Detached stamens.
3. Stamens separated showing the connectiva, not more lobed than in *Coccinia.*
4. Apex of the ovary, with calyx, styles and stigmas.
5. Ovary cut transversely.
6. A seed.
7. A cotyledon and radicle.
8. A seed cut transversely.

Luffa pentandra.

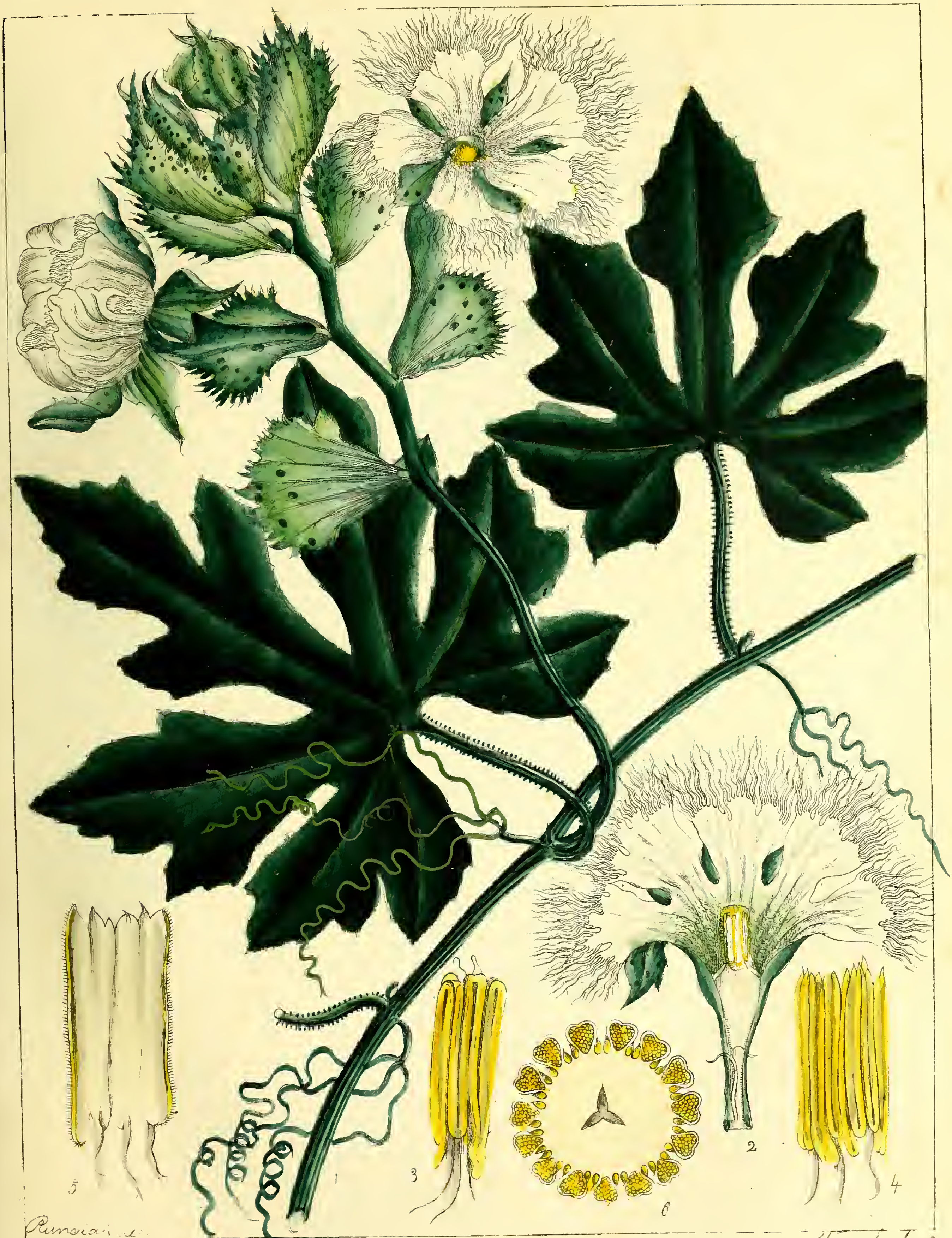
1. Male flower corolla removed, anthers undulating on the margin, but not lobed.
2. Female flower similarly dissected.
3. Ovary cut transversely.
4. A portion of it cut vertically.
5. A seed.
6. Cut transversely.

Mukia scabrilla.

1. Male flower.
2. The same opened showing the anthers from within, not cohering, and abortive ovary.
3. Anthers different views.
4. Female flower.
5. The same, corolla removed.
6. A mature fruit.
7. The same cut transversely, 2-celled with 2 seed in each.
8. A seed somewhat smaller than nature.
9. The same magnified, rough on the surface.
10. Cut transversely.
11. Divided longitudinally.
12. Cotyledons, testa removed.

Cucumis trigonus.

1. Male flower, split open.
2. Stamens detached, one of them separated and seen from within.
3. Female flower dissected, showing the styles and stigmas

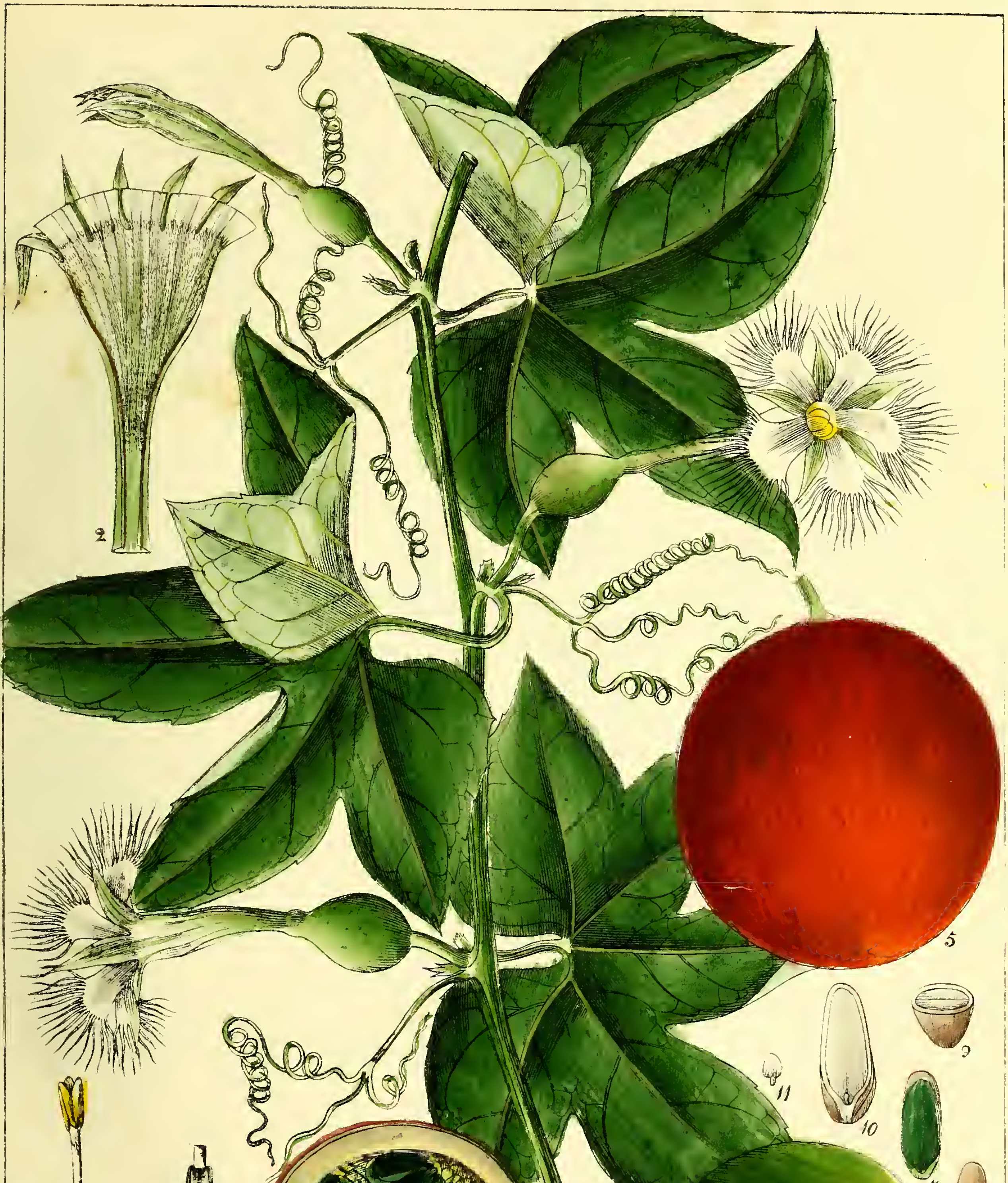


Rungiah

Winchester lith.

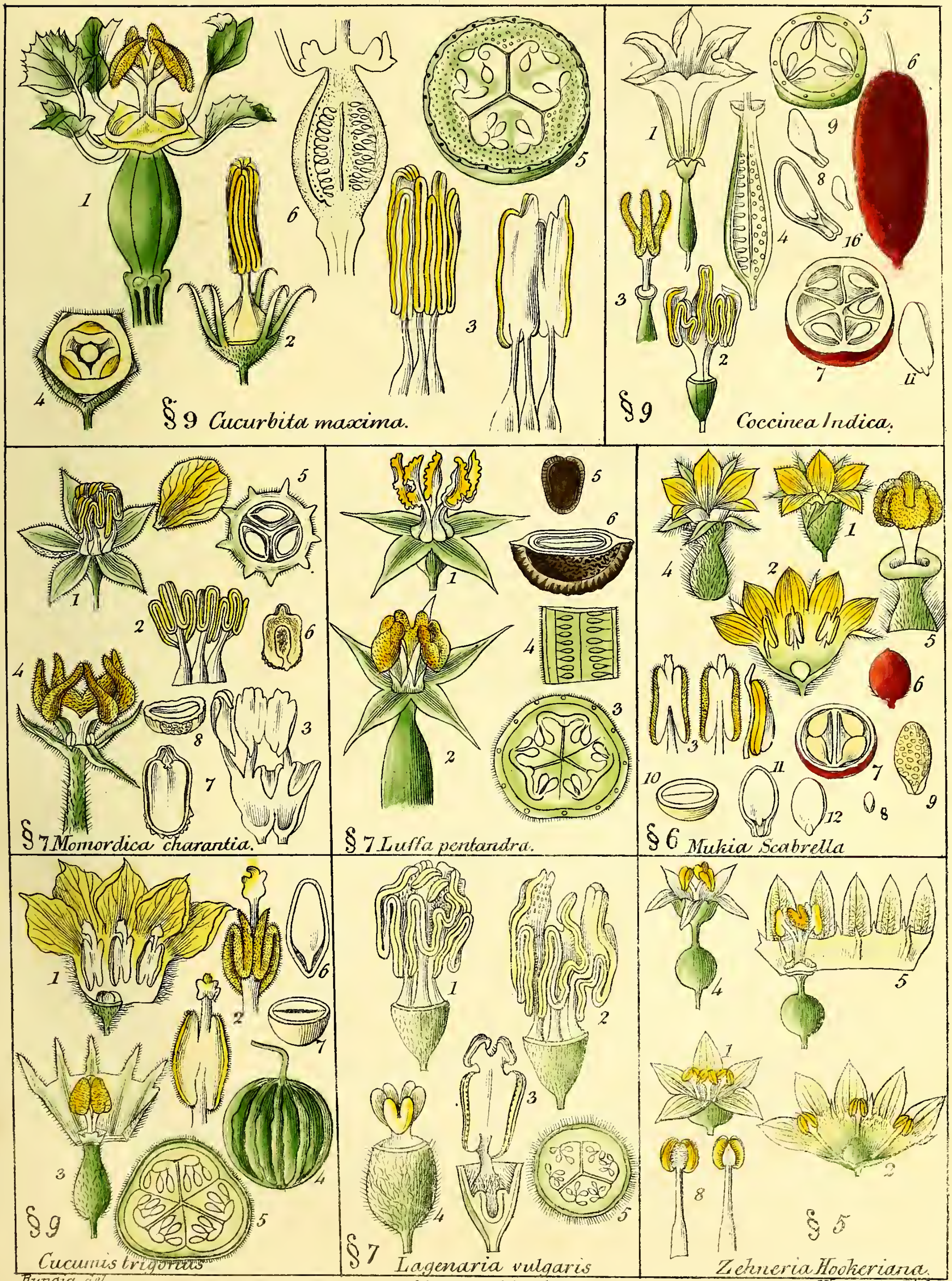
TRICHOSANTHES PALMATA ♂ (ROXB.)

Ancorultay } Tam



Winchester Lith.

TRICHOSANTHES PALMATA ♀ (ROXB.)



Rungia del. Colored by E.A. Rodrigues. Winchester Lith:

4. A young fruit.
5. The same cut transversely.
6. A seed divided vertically.
7. Cut transversely.

LAGENAREA VULGARIS.

1. Stamens as seen when the corolla is simply removed.
2. The same, the anthers separated to show their lobed form.
3. A detached stamen showing it lobed but not much more so than in *Coccinea*.
4. Ovary, style and stigmas.
5. The same cut transversely.

ZEHNERIA HOOKERIANA.

1. Male flower, stamens free.
2. The same split open, showing the insertions of the stamens and large abortive ovary.
3. (By mistake 8) detached stamens.
4. Female flower and ovary.
5. The same split open to show the styles and stigmas and abortive stamens

OBS.—This figure was prepared from dried specimens, but appears sufficiently perfect to show that § 5 and 6, might without inconvenience, perhaps with advantage be united so far as the stamens are concerned for the anthers of Mukia do not cohere though connivent and less distinctly free than those of Zehneria.

The plate as a whole amply I think establishes the position with which I started, that the sections are too numerous.

LXIX.—PAPAYACEÆ.

This, though one of the smallest, is yet, in some respects, a very interesting order. The number of its species seem to amount to only 6 or 7, and form two genera, neither of which are considered of Indian origin. The Papaw tree, the only one met with in India, being introduced from America. This tree is usually supposed to be always diœcious and I have even heard the possibility of the union of the sexes on the same plant questioned. The prevalence of this opinion combined with the general acquaintance, in India, with the usual form of the tree, has induced me, in the accompanying figures, to present unusual forms, partly with the view of removing such erroneous opinions, but principally to illustrate a point in vegetable physiology not generally understood. I allude to power which vegetables possess, in particular circumstances, of developing organs which are usually suppressed. In the first of these plates we have an instance of a ramous specimen of this tree, to show, that though it rarely developes lateral buds, yet, that they exist in the axil of each leaf and are readily developed when the terminal one has been injured. The main trunk of this tree had been injured and many lateral buds are developed and now form vigorous branches. The next presents two panicles of male flowers every branch, of the larger of which, is furnished with one or more fertile flowers: the smaller is the usual form without fertile flowers: the former was taken in June from a tree growing in moist rich soil on the bank of a canal, in the then cool and humid climate of Quilon; the other grew in Madras. The monœcious plant is also of frequent occurrence in the cool climate of Kandy in Ceylon, but I have never seen a single instance of the kind in the hot dry climate of the Carnatic. This fact affords a strong confirmation of the truth of an observation of Mr. Knight, that he could render melon plants much more prolific of fruit by cultivating them in a very cool atmosphere, almost every flower produced in such circumstances being fertile, while male flowers predominated in opposite circumstances. In the Papaw, this is accounted for by each male flower being furnished with an ovary, usually rudimentary, but which is yet capable of becoming fertile.

The Papaw is, except in the circumstances above mentioned, nsually a tree without branches with a cylindrical succulent lactescent stem, of so very rapid growth that it often attains sufficient maturity to bear fruit within 18 months from the time the seed was sown. The leaves which are large digitately palmatifid on long hollow petiols without stipules, form a capacious tuft or crown on the apex: the male flowers form large drooping panicles while the females are nearly sessile.

" Flowers unisexual. Calyx minute, 5-toothed. Corolla monopetalous, inserted into the base of the calyx, in the male tubular and 5-lobed; in the female divided nearly to the base into five segments. Stamens 10, inserted on the throat of the corolla: anthers introrse, 2-celled, bursting longitudinally; those alternate with the lobes of the corolla on short filaments, those opposite to the lobes sessile. Ovarium free, 1-celled: ovules indefinite: stigmas sessile, 5 lobed, lacerated. Placentas 5, parietal. Fruit succulent, indehiscent, 1-celled. Seeds indefinite, parietal, enveloped in a loose mucous coat: testa brittle, pitted. Embryo in the axis of

a fleshy albumen : radicle slender, turned towards the hilum : cotyledons flat.—Trees without branches. Leaves alternate, lobed, on long slender petiols."

Affinities. Jussieu originally arranged *Carica* and the genera now referred to *Passifloreae* as allied genera, under *Cucurbitaceae;* remarking, that they were principally distinguished by their superior ovary, he like others considering the Peponida as a 1-celled parietal fruit, and thus placed them between *Cucurbitaceae* and *Urticaceae*. Their affinity with the former is still asserted but not with the latter. In my remarks on *Cucurbitaceae* I have shown that in common with all other parietose orders they can have no very close affinity with that family on account of the wide difference in the structure of their ovary. With *Passifloreae* they are closely connected by one character, common to both, but not constant in all the species, the placentas, namely, being spread over the whole surface of the carpels in place of confined to their lines of junction. The seed, which I have not seen well described, may perhaps afford other characters. It is enclosed with a quantity of thin mucous pulp, in a hyaline sack, arillus? is of an oval shape, the testa thick, exteriorly black and of a loose cork-like texture, rough and corrugated internally firmer, polished within. Sir W. J. Hooker describes it, as about the size of a hemp seed, "roundish, compressed, almost black, but covered with a transversely wrinkled, loose, greyish, skin or arillus, and enveloped in muçous." This description does not quadrate with specimens now before me—the testa of which evidently consists of 2 layers, an outer one spongy or suberose, furrowed, and an inner denser and polished within, enclosed within a loose transparent sack but no proper arillus. The seed itself agrees in structure with those of both *Euphorbeaceae* and *Urticaceae*, as does those of *Passifloreae*, which however form only a remote affinity when not supported by characters taken from the ovary or mature fruit. I look upon *Papayaceae* as more nearly related to *Passifloreae* than to any other order, though sufficiently distinct.

Geographical Distribution. America is the native country of this order, which is only known in other countries as objects of cultivation, but as such, the Papaw has become widely distributed, apparently readily adopting itself to every variation of climate within the tropics.

Properties and Uses. These are about the most curious of any yet met with in the vegetable kingdom, but so little known in India, that I am under the necessity of having recourse to the experience acquired in the West Indies to make them known. These accounts though rather too long for this work I shall not attempt to abridge, but introduce in the words of the originals. One circumstance I have observed, not mentioned by either, is, that the ripe seeds when chewed yield in a very marked degree the pungency and flavour of *nasturtium* or Indian cress. This flavour and taste is possessed by the seed proper, not the testa, which is insipid. The first of the following extracts is from the pen of Sir W. J. Hooker, published in the Botanical Magazine, Nos. 2898 99—and the last from a paper by Dr. Holder, long a medical practitioner in the West Indies, published in the Wernerian Memoirs, vol. 3d page 245.

"The *Papaw Tree* is of rapid growth. St. Pierre probably spoke from his own knowledge, when he described Virginia as having planted a seed, which, in three years' time, produced a trunk twenty feet high, with its upper part loaded with ripe fruit. It is for the sake of this fruit, mainly, that the plant is cultivated ; but if the flavour were not better than that yielded by what ripened in our stove, I cannot recommend it as at all agreeable. Brown in his Natural History of Jamaica tells us, that "it has a pleasant sweetish taste, and is much liked by many people ; that, while young, it is commonly used for sauce ; and when boiled and mixed with lime juice and sugar, is not unlike, or much inferior to that made of real apples, for which it is commonly substituted." In the opinion of Sloane it is not a very pleasant fruit, even when helped with pepper and sugar ; and the more ordinary use, he adds, of this fruit, is before it is ripe, when, as large as one's fist, it is cut into slices, soaked in water till the milky juice is out, and then boiled and eaten as turnips, or baked as apples.

The juice of the pulp, according to Descourtilz, in the Flore Medicale des Antilles, is used as a cosmetic, to remove freckles on the skin, caused by the sun ; and the negroes in the French colonies employ the leaves to wash their linen instead of soap.

As a medicinal plant, the *Papaw Tree* is particularly deserving of notice. Hermandez long ago spoke of the milky juice of the unripe fruit as a powerful vermifuge ; which has been

confirmed by M. Charpentier Cossigni, as mentioned in the Asiatic Researches, by Dr. Fleming (vol. ii. p. 162). A single dose, that gentleman says, is sufficient to cure the disease, however abundant the worms may be. Another French writer (Poupée Desportes) recommends the use of the powder of the seed instead of the juice.

But the most extraordinary property of the *Papaw Tree,* is that which is related, first I believe by Browne, in his Natural History of Jamaica ; namely, that "water impregnated with the milky juice of this tree is thought to make all sorts of meat washed in it very tender; but eight or ten minutes steeping, it is said, will make it so soft that it will drop in pieces from the spit before it is well roasted, or turn soon to rags in the boiling." Mr. Neill mentioned this circumstance more fully in his interesting Horticultural tour through Holland and the Netherlands; and it has repeatedly been confirmed to me by gentlemen of this country who have been long resident in the West Indies, and who speak of the employment of the juice for such a purpose as of quite general occurrence; and more, that old hogs and old poultry, which are fed upon the leaves and fruit, however tough the meat they afford might otherwise be, it is thus rendered perfectly tender; and good too, if eaten as soon as killed, but that the flesh very soon passes into a state of putridity.

Whether this power of hastening the decay of meat be attributable to the *animal matter* or *fibrine* contained in the juice of the *Papaw* or not, I will not pretend to say, but the presence of such is a fact scarcely less wonderful than the property just alluded to. Two specimens of the juice were brought from the Isle of France ; in the one the juice had been evaporated to dryness, and was in the state of an extract; in the other, the juice was preserved by being mixed with an equal bulk of rum. "Both were subjected to analysis by Vauquelin. The first was of a yellowish-white colour, and semitransparent. Its taste was sweetish. It had no smell, and was pretty solid; but attracted moisture when kept in a damp place. The second was reddish-brown, and had the smell and *taste* of boiled beef. When the first specimen was macerated in cold water, the greatest part of it dissolved. The solution frothed with soap. The addition of nitric acid coagulated it, and rendered it white; and when boiled, it threw down abundance of white flakes. When the juice of the *Papaw* is treated with water, the greatest part dissolves; but there remains a substance insoluble, which has a greasy appearance. It softens in the air and becomes viscid, brown, and semitransparent. When thrown on burning coals it melted, let drops of grease exude, emitted the noise of meat roasting, and produced a smoke which had the odour of fat volatilized. It left behind it no residue. The substance was *fibrine.* The resemblance between the juice of the *Papaw* and animal matter is so close, that one would be tempted to suspect some imposition, were not the evidence that it is really the juice of a tree quite unquestionable."

This *fibrine* had been supposed, previously, to belong exclusively to the animal kingdom : but it has since been found in other vegetables, especially in *Fungi.*

"The effects of the juice of the *Carica Papaya*, or Papaw Tree, whether of the fruit, stem, or leaves, or even of the exhalation from the plant, in lessening the cohesion of the muscular fibre, and acting on the fibrin of the blood, are matters of common observation in the Island of Barbadoes; the inhabitants availing themselves of this property, to render more delicate, when thought necessary, the beef, mutton, pork, and poultry of their tables. If the milky juice, which is readily procurable by incision into the tree, or unripe fruit, be thoroughly rubbed on the flesh of a tough or old animal, and the animal be cooked by roasting, the fibres so completely lose their cohesion, that the flesh will fall from the bones, or be separated by the slightest force. If a smaller quantity of the juice be used, the flesh will be rendered tender; but so great is the effect, and so difficult is it to ascertain the degree to which it may be carried, if the milky juice be directly applied to the flesh, that another and more certain mode has been resorted to, for procuring the inteneration of the flesh of different animals. By simply suspending the animal to a bough of the tree, for a space of time proportioned to the size of the animal, or of the joint of meat, the flesh is found to be sufficiently intenerated. A particular friend of mine, was in the constant habit of having his meat so prepared for his table, and was particular enough (or thought it necessary), to use his watch to regulate the time of suspension.

This quality of destroying the cohesion of the muscular fibre, probably resides chiefly in the milky juice, or in the vapour, which, I conjecture, is exhaled from the tree, since the boiled fruit, when given to animals, does not produce this effect to such a degree as to be sensible. The

fruit is used by all ranks of people ; cooked in its unripe state, as a vegetable ; or served up, when ripe, as part of the dessert, with perfect impunity.

It is a common practice with some of the farmers of the Island of Barbadoes, to give an infusion of the raw fruit ; or, to speak more exactly, a diffusion of the milky juice in water, extracted from the fruit, to horses, with a view, as they express it, "of breaking down the blood ;" and it is a fact, well established, that if given to a horse, whose blood exhibits the cupped buffy coat, it will, after some time, produce a loose coagulum, and reduce the inflammatory symptoms which gave rise to it. I understood, from my friend, the late Dr Jones, of Barbadoes, well known in this University, by the publication of an ingenious experimental Thesis, that he had ascertained this to be the effect of the papaw juice on a horse, which had cough, and whose blood was buffy; and this account has very recently been confirmed to me, by a near connection of Dr. Jones's, a gentleman who formerly lived with him, and who is at present a residenter in this city, as a student of medicine.

That this remarkable effect is independent of putrefaction, or of a process verging to putrefaction, is rendered extremely probable, by the fact, that it is not confined to dead muscular fibre, but is produced on the circulating blood ; or, at least, on one of its constituent parts. At the same time, the consequence of this effect will no doubt be, by its mechanical operation, to promote and hasten putrefaction, on account of its destroying the cohesion of the flesh, and separating the fibres. This is a fact so well known to the housewives of the colony, that they will not purchase, for salting, pork which has been partly fattened on the boiled fruit of the papaw (a practice commonly followed by the negroes of the colony), on account of the flesh not being sufficiently firm for salting ; or, at least, because they find, by experience, that, after having undergone the process of salting, it will not keep as long, or as well as flesh of hogs which have been fattened on any other aliment. What is remarkable, this effect is observable, although the flesh of a recently killed animal, fed on the boiled papaw fruit, is not sensibly intenerated : For a society of gentlemen, who were in the habit of dining periodically with the late Governor of Barbadoes, Sir George Beckwith, fed several animals in this way, with a view to ascertain the effect on the flesh. We found, that when the animals so fattened, were served up, their flesh was not, to the taste, more tender than that of other animals at the table, fed in the common mode.

The health of animals fed on the *Papaw*, is not injured by that diet.

I may add, that the juice of the *Papaw* has been, by some, administered as a vermifuge to children, whether with marked success I am doubtful.

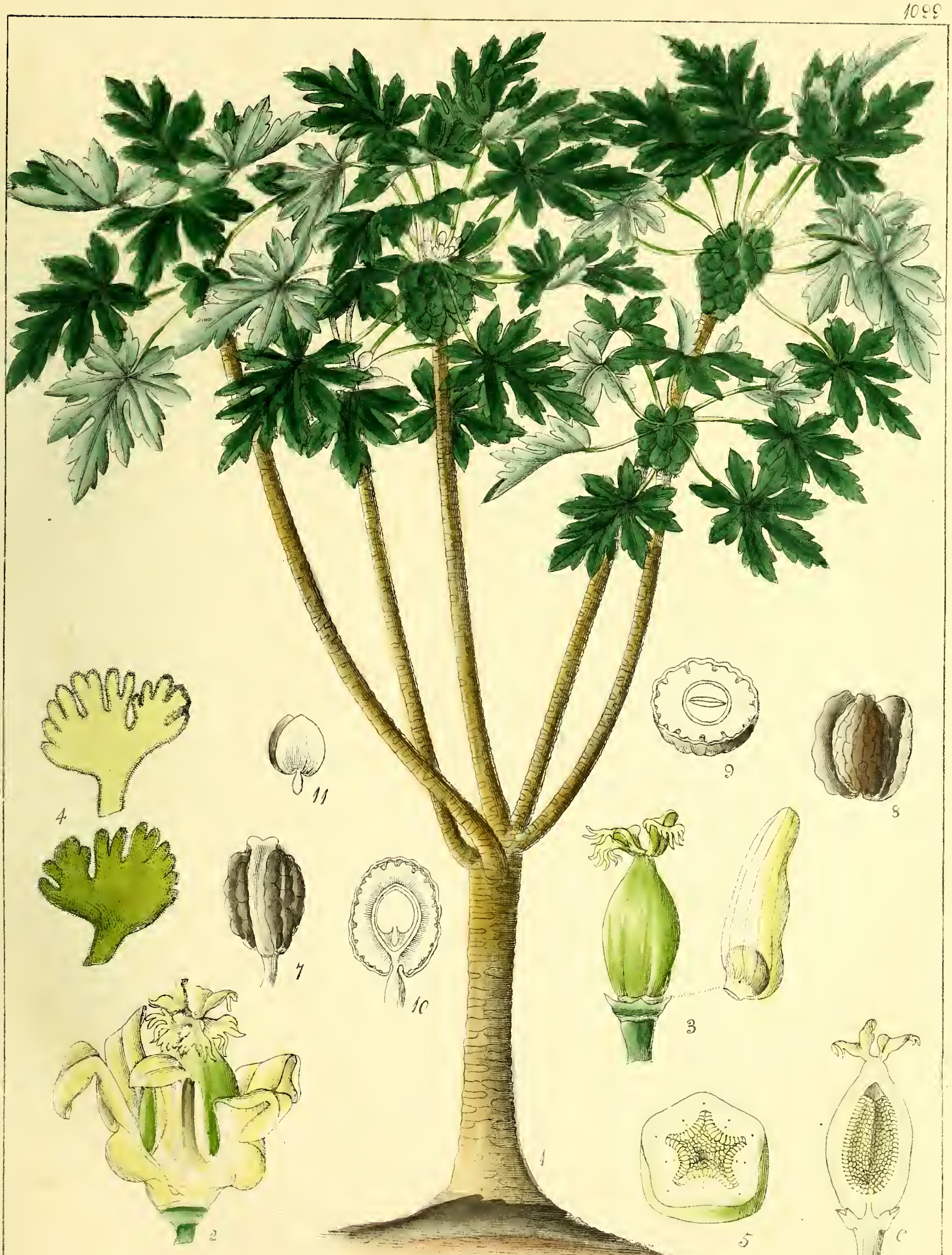
The chemical analysis of the juice of the *Carica Papaya* has given, in the hands of Vauquelin, some very curious results : from them, he draws the following conclusion.

" I think," says he " that there cannot be any doubt that the juice of the *Papaw* is a highly animalized substance ; at least it possesses all the characters, and yields all the products of one. I confess that it has no perfect similitude with any known animal matter. Nevertheless, I believe that which it resembles most, is animal albumen ; since dried, it dissolves, like it, in water. Its solution is coagulated by heat, by the acids, by the alkalies, the metallic solutions, and the infusion of nut-galls. And, in fine, because, by distillation, it yields the same products as any animal substances whatever. It is not the animal nature of this substance which ought to surprise us ; for the juices of almost all plants contain some of it ; but its abundance and its purity in that of the papaw."

EXPLANATION OF PLATE 106.

Carica Papaya—female plant.

1. A full grown tree, presenting the unusual appearance of bearing several large branches, attributable to the terminal bud of the parent stem having been injured which caused the lateral ones to shoot.
2. A female flower, *natural size*.
3. Ovary and calyx, petals detached.
4. Portions of the stigma more highly *magnified*.
5. Ovary cut transversely.
6. Cut vertically—one-celled, the whole inner surface covered with ovules.
7. A seed enclosed in its sack or arillus.
8. The sack opened showing the seed.
9. Seed cut transversely, showing the embryo in the midst of a large albumen.
10. Seed cut vertically showing the embryo *in situ*.



பப்பாளிமரம்
Puppalle marum } Tam

CARICA PAPAYA (LINN.)

బొప్పాయి మాను
Bopaye manoo } Tel

பப்பாளிமரம்
Parpalle-maram } Tam.

CARICA PAPAYA (LINN.)

బొప్పాయిమాను
Bopaye-manoo } Tel.

EXPLANATION OF PLATE 107.

1. A panicle of flowers of *Carica Papaya* taken from a male tree, but in this instance having female flowers mixed.
2. A male flower split open, showing the 2 rows of stamens and abortive ovary in the bottom of the tube.
3. One of the female flowers detached and the petals forced open to show the ovary.
4. The same, cut open.
5. A Papaw taken from the same tree smaller than those produced on the female tree, but otherwise perfect.
6. The same cut vertically showing the seed *in situ*.
7. Portion of a panicle of male flowers the usual form.
8. Male flowers split open.
9 & 10. Back and front views of the stamens.

LXX.—PASSIFLOREÆ.

This like the last can scarcely be viewed as an Indian order, a very few species only, out of nearly 200 described in Botanical works, having yet been met with in Asia. America, especially the warmer provinces is the grand storehouse of these elegant and deservedly much admired flowers.

This family approaches *Cucurbitaceae* in its tendril bearing stems and diffuse climbing habit, but in scarcely any other well marked particular. Its flowers are very different, its fruit are superior and distinctly parietose, and its seed are albumenous. Notwithstanding these important differences nearly all Botanists agree in placing these orders next each other, and Jussieu even united them, not however without remarking on the very different position of the ovary in the two tribes. In habit their agreement is so strong that without examination of the flowers or fruit our species of *Modecca* might readily be referred to *Cucurbitaceae*, but the slightest examination of either flower or fruit at once shows a wide difference. Lindley however remarks " there can be no doubt that *Cucurbitaceae* are really little more than *Passifloreae* with inferior fruit" an opinion we shall consider more at large when we come to consider their affinities. The order is thus characterized.

" Sepals 5 (rarely 4), foliaceous, united below into a short or elongated tube, the sides and throat of which are lined with a *corona* composed of filamentous or annular processes. Petals perigynous, inserted between the corona and the calyx-segments, with which last they are as numerous, and alternate, usually almost homogeneous with and shorter than them, very rarely larger than them and with the usual appearance of petals, sometimes wanting. Stamens 5 (very rarely indefinite), monadelphous, usually with processes from the torus between them and the petals: anthers inserted by their base, 2-celled, bursting longitudinally on the inner side (but, from their being often reflexed, apparently opening outwardly.) Ovarium free, 1-celled: ovules indefinite, attached to 3 (or very rarely 4), parietal placentæ: styles 3 (or very rarely 4), or none. Fruit naked or surrounded by the calyx, 1-celled, usually 3-valved, sometimes dehiscent and loculicide, sometimes fleshy and indehiscent. Seeds indefinite, compressed, with an arillus or strophida: testa brittle sculptured. Embryo straight, in the centre of a thin fleshy albumen: radicle pointing to the hilum."

Affinities. It is an axiom in Botany, in the determination of natural affinities of plants that the nature of every part of the plant must be understood and explained, to enable us to compare one organ with another in different families, and in that way ascertain in what points they associate and in what they differ. This is not always an easy task, and in the present instance, the elucidation of the parts of the flower has given rise to much difference of opinion among the leaders of the science.

Jussieu first described the parts called petals in the above character as an inner division of sepals, and viewed the order as apetalous. DeCandolle so far agrees in this view, as to call the inner row sepals, but nevertheless considers the order polypetalous which, Lindley well remarks, " he is unable to understand on the supposition of the inner series of floral envelopes being calyx," and therefore, with other Botanists considers the outer series as the calyx and the inner as petals, first, because they have the ordinary position and appearance of calyx and corolla, the outer being green the inner coloured, and secondly, because there is no essential difference between the calyx and corolla except the one being the outer and the other the inner of the floral envelopes. Neither Endlicher nor Meisner, both of whom quote his work, seem to coincide in the correctness of this view, since they both describe its floral envelopes as a perigonium corolla like 8-10 cleft, with an outer and inner series, but both arrange the family among orders having

double floral envelopes, that is, a calyx and corolla, thereby, determining its place in the system, solely by the structure of the ovary, leaving the corona, the most conspicuous part of the flower, altogether out of their consideration.

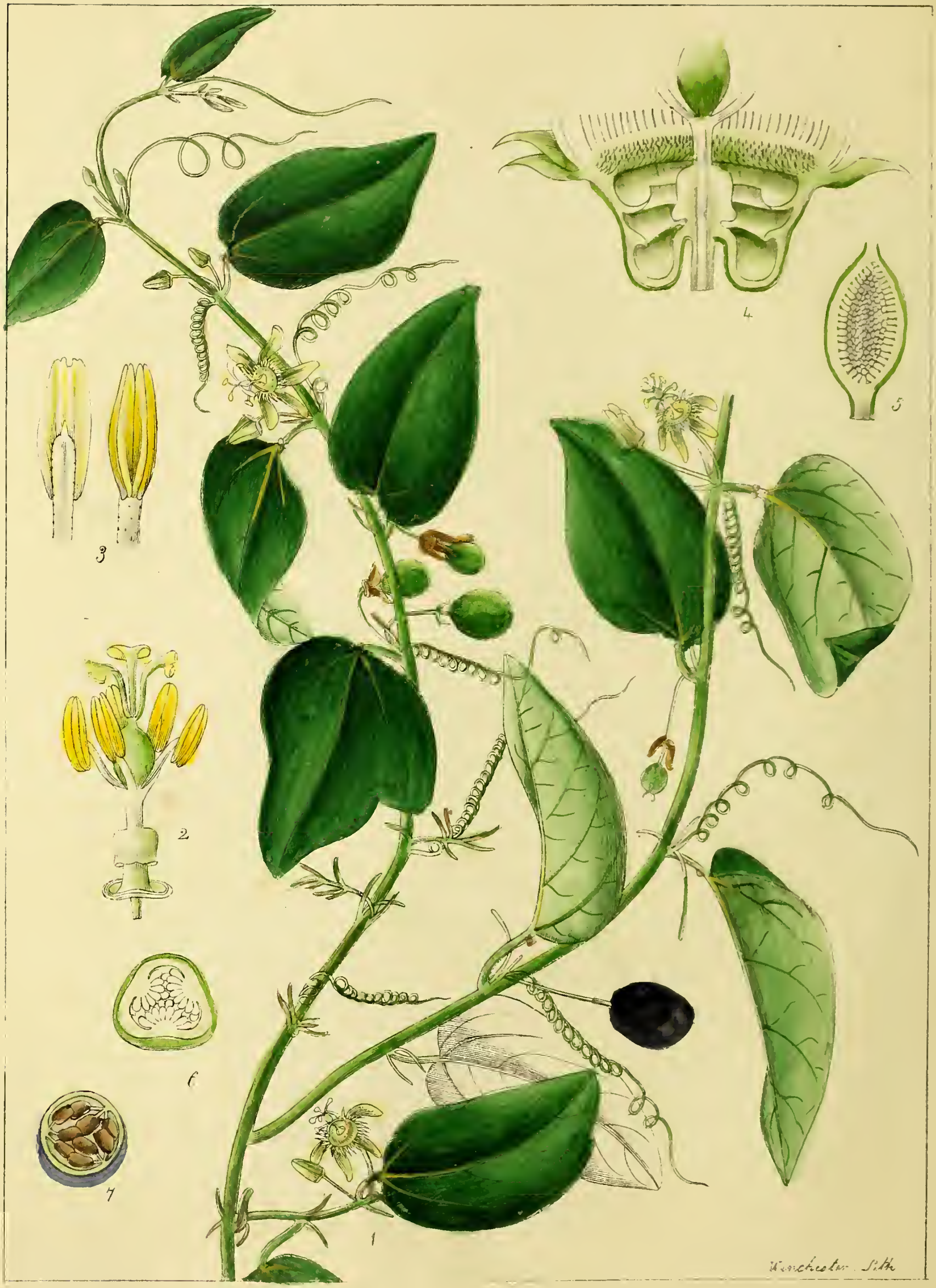
In this it appears to me all have erred, for if the above stated axiom is of any value it must be either uniformly acted up to, or altogether discarded. and to say merely that they are processes gives no information. Lindley remarks of them, that they are " apparently metamorphosed petals," and afterwards adds. " The nature of the filamentous appendages, or rays as they are called, which proceed from the orifice of the tube, and of the membranous or fleshy, entire or lobed, flat or plaited, annular processes which lie between the petals and the stamens, is ambiguous. I am disposed to refer them to a peculiar form of petals, rather than to the stamens, for reasons which I have assigned in the Hort. Trans. vol. 6, page 309, for understanding the normal metamorphoses of parts of fructification to be centri-petal." In this opinion I fully coincide as, to me, it appears quite unquestionable that these filamentous or annular processes constitute in reality the corolla of these curious and unique flowers as they occupy the same place in the flower which, in more regular flowers, the corolla does. There is a double series of sepals, in like manner there is double series of these processes, at least so it is in *P. laurina*, the species now before me, the exterior smaller the interior larger. In further confirmation of this view we find between them and stamens, the regular situation, the torus, but so much produced that after lining the tube of the calyx (the true nectarium of this plant,) it forms a curtain, as it were, embracing the podocarp, by which the communication between the upper and lower portions of the tube is intercepted (see plate 108, fig. 4). Should this explanation be admitted, we can satisfactorily account for a portion of the structure, not hitherto clearly made out, and at the same time enable us with strict propriety to retain the order in its present place, among the polypetalous orders.

The above character might then be thus modified : sepals 10 (rarely 8) in a double series, the inner series petaloid, united below into a more or less elongated tube : corolla perigynous. polypetalous, heteromorphous, composed of numerous filamentous or annular processes ; torus lining the tube of the calyx reflexed at the insertion of the corolla forming a free margin. Stamens, &c.

This structure, shows at once, that in so far as the flower is concerned, we cannot without considerable violence adopt the opinion above quoted, that the passion flower is little else than an inferior flowered *Cucurbitacea*, no *Cucurbitaceous*, plant having such a complex flower, still less can we adopt this opinion on a comparison of the fruit, which, as stated under *Cucurbitaceae*, are most widely different. Had the ovary and fruit been similar in the two orders, I should not have hesitated in adopting that view, but cannot, while I find such obvious differences in both flowers and fruit. The nearest relation of this order is, as already stated, *Papayaceae* which, so far as I can judge from figures and descriptions, is even more nearly allied than either *Loaseae* or *Malisherbiaceae*, though the latter is united as a section of it by DeCandolle.

Geographical Distribution. As already stated America is the head quarters of this family, but they extend thence to Asia, Africa and the tropical parts of Australia, none to Europe. In South America and the West Indies they abound, climbing from tree to tree and filling the woods with their beautiful and singular flowers. Of the genus *Passiflora* we have have certainly 2 species in India, *P. Leschenaultii* from the Neilgherries, Pulneys and Shevaroy hills and *P. nepalensis* from Nepaul ; a third is *P. Moluccana* found in the Straights of Malacca. The one I have figured as a new species was so named and the impression printed before I had an opportunity of examining good specimens, I have since met with it in the garden of the Horticultural Society of Mysore, or, one so accurately corresponding with the figure that I have no doubt of its being the same, and that, from the character, I consider either *P. minima*, or *P. suberosa*, species, judging from characters only, scarcely distinct. If really distinct from both those indicated, and it prove a native of Ceylon, I should then infer it formed the bases of Gærtner's genus *Vareca*, the fruit of which as represented by him agrees very well with dried specimens of this species, when gathered before quite ripe.

The genus *Modecca*, is principally of Asiatic and African origin, one is from Autralia, but none has yet been observed in America. The species however appear to be more numerous in Java than India, half of those described being from that Island.



PASSIFLORA WALKERIÆ (R.W.)

Properties and Uses. On this subject almost nothing is known, the fruit of some species of *Passiflora* are edible and the succulent juicy pulp which surround the seed is cooling and pleasant to the taste. The root of one species, *P. quadrangularis*, is said to be powerfully narcotic, a dose of the infusion, administered to a dog, having killed him in 40 minutes after its administration and almost immediately knocked him down, as if struck with apoplexy. Little however seems known of it beyond that experiment, as it does not seem to have been employed as a remedial agent in the cure of disease. I have no where heard that our species of *Modecca*, have been applied to any useful purpose.

Remarks on Genera and Species. There being but two genera, so far as yet known, natives of the Peninsula, and these containing between them only three species, all of which I have figured in the Icones, it seems unnecessary to devote space to them here. The one represented here, for the figure of which I am indebted to the elegant pencil of Mrs. Walker, was found in Ceylon, where it was supposed a native and a new species, I have, as already stated, seen reason to fear is not a native but an introduced plant, as it accords in almost every particular with the characters of both *P. minima* and *suberosa* especially the latter, a figure of which in Smith's Exotic Botany I have seen, except in the smaller size of its fruit. The following description is taken from a plant growing in the Horticultural Society's Garden at Bangalore.

Passiflora Walkerii (R. W. P. minima? Jacq. P. suberosa? Lin.) A small climbing plant, leaves ovate 3 or slightly 5-nerved, the exterior pair much smaller, entire or somewhat three-lobed, the middle lobe the largest, succulent, glabrous, without glands; petiols shorter than the leaves, with two prominent glands near the apex; tendrils simple: peduncles twin, axillary, simple, one-flowered, jointed about the middle and furnished with two minute caducous subulate bracteas at the joint; no involucrum: calyx 5-cleft, inner series wanting, coronal appendages in four series, first, the inner one a brown ring—2-a plaited lobed membrane the margin of the lobes ciliated, 3 a circle of erect capitulate filaments—and lastly—the petaloid series consisting of a ring of spathulate filaments reflexed and redish at the apex purple towards the base. Fruit a small purple berry with several rough seed enveloped in sweet pulp.

I cannot feel certain that the plant described is identical with the one figured, but trust that the minuteness of the above description aided by the figure will enable any Ceylon Botanist, who may meet with the plant, to determine that point. For figures of the continental species of this order, see Icones—No. 39, 179, 201.

The analysis figures 2, 3, 4, 5 and 6 are taken from *P. laurifolia*, and were made by Rungiah. The figure of the plant and section of the fruit No. 7, I owe to the kindness of Mrs. Walker.

EXPLANATION OF PLATE 108.

Passiflora Walkeri (R. W. P. suberosa? Jacq)
1. A flowering branch, *natural size.*
2. Stamens, podocarp and ovary.
3. Anthers.
4. Transverse section of the tube of the calyx, showing the free curtain-like extremity of the torus (?) embracing the podocarp and cutting off all communication between the upper and lower portions of the tube.
5. Ovary cut vertically.
6. Cut transversely, one-celled, with three parietal placentas.
7. Transverse section of the mature fruit.

LXXI.—PORTULACACEÆ.

LXXII.—PARONYCHIACEÆ.—LXXIII.—FICOIDEÆ.

In our Prodromus these orders are viewed as quite distinct and not even ranged in a consecutive series. In this course we followed DeCandolle, and, according to my present ideas on the subject, allowed ourselves to be misled by that high authority on all matters relating to affinities of Plants.

These three orders in common with *Caryophylleae*, (already treated of) *Chenopodiaceae Phytolacceae, Polygoneae*, and five or six others are connected by one common link, namely, by having the *Embryo applied to the side of, or, more commonly, curved round a mealy albumen.* The orders associated by this seminal structure, though often apparently, widely separated by characters taken from the flower, are yet, all so intimately blended in their several relationships, that no two Botanists seem agreed either as to the genera referable to each, or as to the orders among which they should be grouped as their nearest allies. Guided by this clue to

their real affinities, it becomes a curious and interesting, though by no means easy enquiry, to trace the various attempts that have been made by different authors, to construct a natural arrangement of these plants while excluding this their only truly natural and constant bond of union. Some of these arrangements I shall endeavour to exhibit, partly in support of the assertion advanced, that no two Botanists are agreed on these affinities, but principally to prove that, so long as we take the different degrees of development of the flower as the basis of our natural system of Botany, we build on a bad and unstable foundation.

Lindley has employed this character, in the construction of his *Alliance Silenales*, the perfection of which, however, through his not perceiving the full value of his character, "embryo rolled round mealy albumen," he has marred, by the introduction of *Tamariscineae* (an order in which it is wanting and but remotely if at all allied) on the one side and the exclusion of *Ficoideae* on the other. This last he has in my opinion most injudiciously placed in his alliance *Cucurbitales*, for no reason that I can perceive, its fruit being neither epigynous nor its placentas parietal.

The following are the polypetalous orders which participate in the character and ought to have been associated in that alliance. I use Lindley's names. *Portalaceae*, *Silenaceae*, *Alcinaceae*, *Illecebraceae*, *Ficoidaceae*, and perhaps *Surianaceae*. The remaining orders agreeing in this character 7 in number are arranged by Lindley in his group *Curvembryosae* (sub-class *incomplete*) they are, *Amarantaceae*, *Chenopodiaceae*, *Phytolaccaceae*, *Polygoneae*, *Petiveraceae*, *Scleranthaceae* and *Nyctaginaceae*. *Menispermaceae*, placed in this group on account of its curved embryo, I exclude, as having no other affinity, its albumen not being mealy nor the embryo on one side curved round it. This it will be perceived is considerably different from DeCandolle's arrangement who places *Caryophylleae* in his first class, *Thalamiflorae*—*Portu aceae*, *Paronychiaceae*, and *Ficoideae* in his second—*Calyciflorae*—and the remaining order in his fourth class *Monochlamydeae*.

Von Martius adopts a different arrangement but being of a mixed character cannot be so easily explained, but the following list of the orders, numbered as they stand in his Conspectus, will show how widely the group is scattered over his system—90 *Chenopodiaceae*—91 *Riviniaceae*—92 *Petiveraceae*—93 *Nyctagineae*—94 *Sclerantheae*—95 *Phytolacceae*—96 *Polygoneae*—235 *Amarantaceae*—236 *Paronychieae*—(a) *Illecebreae*—(b) *Polycarpeae*—(c) *Minuartieae*—261 *Portulaceae*—262 *Caryophyllaceae*—(a) *Sileneae*—(b) *Alsineae?* 263—*Elatineae*. The absence of albumen in the last seems to exclude it from the group. In Endlicher's Genera Planter *Chenopodeae* ranks No. 101—*Amarantaceae* 102—*Polygoneae* 103—*Nyctagineae* 104—*Mesembryanthemeae or Ficoideae* 205—*Portulaceae* 206—*Caryophylleae* 207. (The subsequent parts of the work have not yet reached me)—The first four of these orders form his class *Oleraceae*—the last three form part of his class *Caryophyllinæ* which includes all the genera in our Prodromus referred to *Caryophylleae*, *Portulaceae*, *Ficoideae* and *Paronychiaceae*. Under the name of *Tetragoniaceae* Lindley refers *Sesuvium* and *Aizoon* to Endlicher's *Oleraceae* placing them between *Amaranthaceae* and *Chenopodiaceae* on the one side and *Phytolacceae* and *Polygoneae* on the other.

Could we ask for more conclusive evidence of the intimate relationship existing among all the orders and genera having that very peculiar structure of the seed, than the facts here stated supply? No sooner do we find one Botanist, eminent for his knowledge of affinities of plants, distribute the orders so marked, in the way he thinks most consonant with their natural affinities, than we find another equally celebrated proposing a different arrangement. DeCandolle placed so many of these genera (those of his order *Caryophylleae*), in his class *Thalamifloreae;* so many more (the orders above named) in *Calyciflorae;* and the remainder, those referable to *Chenopodiaceae*, *Amarantaceae*, &c., in his *Monochlamydeae;* thus distributing them all over his system. Lindley, in the first edition of his natural system of Botany, arranges no fewer than 165 orders in a single series, under the heading "*Polypetalous Apetalous and Achlamydeous Plants*," altogether untramelled by system or arbitrary divisions of any sort, and here, it is remarkable, that of 11 orders possessing this structure—mealy albumen with the embryo on one side—9 are, with two exceptions, placed in immediate succession, *Nitrariaceae* standing between *Ficoideae* and *Illecebreae*, and *Begoniaceae*, between *Polygaleae*, and *Nyctagineae*. The remaining two *Caryophylleae*, and *Portulaceae*, are near.

This circumstance shows that their general affinities are such, that the whole might, by that single character, be separated from the rest of the system and grouped in one very natural

class, of sufficient magnitude too, to admit of its being further distributed either circularly or otherwise according to the taste or abilities of the expounder. Unfortunately the author, (Lindley) not seeing the true value of this bond of union, has, in his second edition, changed the arrangement much for the worse. Von Martius places *Chenopodiaceae*, *Nyctagineae*, &c. &c., in one group—*Amarantaceae*, and *Paronycheae*, in a second and *Caryophylleae*, and *Portulaceae*, in a third—Lindley in his second Edition has *Ficoideae* in one group—*Portulaceae*, *Silenaceae*, and *Alsinaceae*, (*Caryophylleae*, of other authors) and *Illecebreae*, in a second—and at a great distance *Amarantaceae*, *Chenopodiaceae*, and several genera referred by all other authors to *Portulaceae*, or *Ficoideae*, in a third.

These examples are I presume sufficient to establish the intimate relationship existing among all the plants possessing this structure, and the impossibility of ever devising a satisfactory distribution of the genera into natural orders that does not set out from that point.

The three orders above named, being united by this structure and being the only ones appertaining to the class *Calyciflorae*, I have, in conformity with these views, thought it the most judicious course to group them together as a sub-class or large order and then redistribute the Indian genera into sub-orders ; leaving for future consideration the final determination of all the orders into which the group ought to be divided, and the station which it ought to occupy in the system of plants. To attempt more than this would be inconsistent with the plan of this work, which does not profess to offer a new arrangement but merely to illustrate that in use, indicating from time to time, as opportunities offer, those points which appear to me defective and how they may be amended.

Portulaceae.

This as now understood by both Meisner and Endlicher is a large and apparently polymorphous order, including several tribes the affinities of which seem rather remote. Both these authors place here, not only the plants referred by us to *Ficoideae*, but also the genus *Mollugo*. This seems a questionable association, though for the present I adopt it, as the true *Portulaceae*, have a central basilar placenta (the seed attached to the bottom of the solitary cell of the capsule) : but in *Mollugo* and *Glinus* (excluding *G. trianthimoides*) the capsule has several cells with numerous seed, attached the whole length of the axis ; having besides, a five not two sepaled calyx and being destitute of proper petals. This case supplies another example of the necessity of viewing the whole of those genera, having the peculiar curvembryose seed of this tribe, as belonging to one great natural family or class and re-distributing them, without reference to what has been already done, according as they can be most naturally grouped into sub-classes or alliances, duly bearing in mind, that the order or class is as it comes from nature's hand a truly natural group and that the object in view is merely to distribute its contents in the most easy and convenient order. Until this course is adopted, it seems most improbable we shall ever have them disposed in such a series as will give general satisfaction. But before this can be done, the whole must be carefully re-examined. In the mean while as I can see no sufficient reason for altogether rejecting the views of these authors, though I confess I cannot fully agree with either, I shall modify the arrangement of our Prodromus by bringing *Sesuvium* from *Ficoideae*, where it does not associate well with *Mesembryanthemum*, to *Portulaceae ;* and *Glinus*, our only other genus of *Ficoideae*, being much less entitled to a place there than even *Sesuvium* I also remove and place with *Mollugo* in a distinct section, which may then be given to *Paronychiaceae* as better agreeing with it, both in habit and in characters, than with *Portulaceae*. In this way, the order *Ficoideae* is removed from the Indian Flora, and justly, so far as these two genera are concerned, as it is clear that *Sesuvium* cannot be separated from *Trianthema* as an order, and neither it nor *Glinus* can very well keep *Mesembryanthemum* company. Let us attempt to distribute the Indian genera according to these views.

The Indian curvembryate genera referable to DeCandolle's class *Calyciflorae*, are nine in number and may be thus distributed.

Portulaceae.— Calyx 2 parted. Corolla 4-5 petaled exceeding the calyx, conspicuous. Capsule one-celled, circumscissile, or opening by valves : placenta central in the base of the cell, seed attached by distinct podosperms.—Succulent herbaceous plants. *Portulaca*, *Talinum*.

Sesuviaceae.—Calyx 5 parted, petaloid within. Corolla none. Ovary one (by abortion ?) or several celled, placenta in the axis of the cells, or when one-celled, cohering to the side: ovules several, superposed, attached by longish podosperms. Capsule usually becoming one-celled by the obliteration of the partitions, or, spuriously, transversely 2-celled, circumscissile (dehiscing transversely) little above the base.—Succulent herbaceous plants. *Trianthema, Sesuvium.*

Paronicheaceae.—Sepals 5, more or less cohering at the base, persistent: petals 5, shorter than the calyx, inconspicuous, or somewhat imperfect, marcescent. stamens 5, or three, by abortion, shorter than the calyx: capsule 1-celled, 3-valved: placenta central in the base of the cell with numerous seed attached by distinct podosperms to the base. *Polycarpea, Hapalosea, Drymaria.*

Mollugineae.—Sepals persistent: corolla wanting or imperfect, the petals resembling sterile stamens: stamens 5-10 sometimes 3 by abortion: ovary free 3-5-celled, placenta in the axis of the cells, extending their whole length; ovules numerous superposed: capsule 3-5-celled dehiscence loculicidal. *Mollugo, Glinus, ? Orygia.*

To this last genus our *Glinus trianthemoides* belongs. It is referred to this section by Endlicher and Meisner, but having a perfect corolla may possibly yet find a more suitable station, though for the present I can propose no better place.

In this distribution I have excluded the name *Ficoideae*, which has especial reference to *Mesembryanthemum*—the *Fig marigold*—a Cape genus of great extent and differing, in appearance, most widely from all the rest of the tribe, not only in its flowers, which are curious, much resembling a radiate composita, but in its fruit, which is very remarkable, but with the structure of which, Botanists, though the plants are now cultivated in every green house in Europe, seem imperfectly acquainted. Professor Endlicher (Genera plantarum) is the only writer, so far as I am aware, who has described its appearance, with sufficient accuracy to lead to the suspicion that it presents any marked peculiarity. DeCandolle describes the ovary as from 4 to 20-celled adnate within the substance of the calyx. (*Ovarium calyci adnatum intus pluriloculare (4-20) saepius 5—loculare*) the capsule as many celled adnate to the calyx and dehiscing in a star-like manner at the summit. No one would suspect from this any peculiarity. Endlicher however takes a different view. He describes the ovary as composed of from 4 to 20-carpels, horizontally verticelled round a thick central axis, with the margins of the carpels, forming the ventral suture free above, or valvately connate, or introflexed forming a more or less perfect spurious partition. Placentas linear, adnate to the middle nerve of the carpel, occupying the bottom of the cell."*

According to this description the usual position of the placenta and consequently of the whole carpel is reversed. The normal structure of a carpel is, for the ventral secture to be placed in the axis and there bear the placenta. Dehiscence, when loculicidal then takes place along the dorsum, or middle nerve, on the side most remote from the axis. Here, according to the above description, we find matters wholely reversed, the dehiscence is loculicidal, but in the place of the dorsum splitting to give passage to the seed, the ventral suture, which in other plants is central and bears the seed, is said to be free and to open to give them passage; while the placentas, in place of being produced by the union of the margins of the carpellary leaves, is said to be generated by the midribs or costæ. Can such an inversion really happen ? I certainly think not, and, therefore, suspect the learned author has fallen into error in supposing the ventral suture of the carpels free and dehiscent, in place of, as they appear to me, attached to a broad gynobase, which, by raising the dorsal face of the carpel from the horizontal to the vertical aspect, produces an appearance of inversion that does not exist. According to this view, which however I offer with considerable diffidence as my acquaintance with the fruit of this genus is altogether derived from the examination of dried specimens of three or four species, the flowers are not epigynous,

* Ovarium cum calycis tubo connatum, e carpidiis 4-20 conflatum, carpidiis circa axim centralem crassam subhorizontaliter veticillatis 4-20-loculare, carpidiorum marginibus suturam ventralem superam constituentibus valvatim connatis v. in septum plus minus distincte introflexis Placentæ lineares carpidiorum nervo medis aduate fundum loculi occupantes." Endl. Gen. Pl. p. 945-6.

in the usual acceptation of the term, but perigynous and the ovary free, as in all the other genera which I propose combining into this *Curvembryose* class, thus establishing the justice of my objection to its introduction into Lindley's epigynous group, while it shows that it might have been correctly admitted as a 5th alliance, into the gynobaseose group between *Coriales* and *Flörkeales*. *Surianeae* placed by Lindley, in this group, next *Coriarieae* apparently belongs to my proposed class, though the albumen is sparing and less distinctly mealy than in the other orders of the class.

Affinities. After the preceding extended discussion of the various relationships of the orders under examination, it seems unnecessary to dilate further on this head than merely to enumerate the orders which I propose combining to form this class; these I shall quote from the list of orders above alluded to in Lindley's first edition, preserving the succession he has adopted (not being as yet prepared to offer an improved distribution), merely observing, that there may be some other orders to be added with which I am unacquainted. They are, *Caryophylleae—Portulaceae—Ficoideae—Illecebreae—Amarantaceae—Sclerantheae—Chenopodeae—Phytolaceae—Petiveraceae—Polygoneae—Nyctageneae*—and ? *Surianeae*. This list of orders, in all of which mealy albumen with an exterior embryo is found, sufficiently attest the value of this structural peculiarity as an ordinal character and it seems not improbable that, when the idea is extensively followed out, other groups of equal value may be thus formed: *Cruciferae* and *Caparideae* for example may form the basis of such another—*Leguminosae* and *Rosaceae* of a third *Euphorbiaceae, Urticeae*, &c. of a fourth *Rubiaceae* and *Myrsineae* of a fifth and perhaps many more. These suggestions are thrown out, nearly at random, as hints, to which, at the present moment, I attach little importance, though others, having a more extensive knowledge of plants, may be able to turn them to good account.

Geographical Distribution. On this head I have but little to say, every part of the world seems to possess plants referable to this group, usually frequenting arid, sandy, exposed soils. In India, neither the genera nor species are numerous, but several of those that are met with are very common. *Portulaca quadrifida* is met with every where; the species of *Trianthema* are about equally abundant, especially *T. obcordata* which is a troublesome weed in almost every garden. The other species are also common, especially *T. decandra*, which is nearly as common as *T. obcordata*. *Talinum* is more rare, seeking a rich rather moist soil in subalpine jungles. *Polycarpeae* are common on hard red soils; *Hapolosea* like *Mollugo* and *Glinus* prefer cultivated ground, *Drimaria* is usually met with climbing among bushes in alpine jungles and much resembles *Holostium* and some others of the chick weed family: *Sesuvium* is confined to saline soils near the coast, *Orygia*, our *Glinus trianthimoides*, is of more rare occurrence, usually met with in black soils, it is common in the ceded districts. At the Cape of Good Hope they abound, to that country *Mesembryanthemum* one of the largest known genera, is almost entirely confined, and species of nearly every genus of all the orders named are also met with in that promontory, in common with all other kinds of succulent plants. As representatives of these orders are found every where it is unnecessary to be more particular.

Properties and Uses. On this head I have nothing to offer, *Portulaca oleracea*, as its name implies, is occasionally cultivated as a pot herb. The young leaves of *Trianthema obcordata* are sometimes similarly employed and, being mostly mild succulent plants, nearly all might be, they possess no medicinal properties.

Remarks on Genera and Species. While examining recent specimens of *Trianthema obcordata* and *decandra*, I detected two grave errors into which we fell in preparing our generic character of that genus. It is there said " capsule one-celled *(or with a spurious longitudinal dissepiment projected from the placenta when the style is 2-parted)* splitting transversely, a little above the base." The words printed in italics is an error. for when the style is 2 partite there are really two carpels and 2 cells the partition between which can be split from the summit showing the cells perfect, each of which is furnished with its own placenta. Again it is said " lid coriacious containing one or two seeds *attached to an unilateral placenta*, bottom membranaceous with one or more seeds attached to a unilateral placenta *on the opposite side from*

that on the lid." The portions in italics are both erroneous, they refer to *T. obcordata* and *Crystalina* in which one of the carpels seem invariably to abort, which is indicated by the solitary style. And, here, when the ovary is examined, in the early stages, it is found to have only one cell, and one placenta cohering to the side of the cell, bearing several ovules supported on filiform podosperms of unequal length. One or two ovules rise to the top of the cell, where they are afterwards enclosed by a spurious transverse division and separate with the lid, but are not otherwise attached to it. With these corrections the character is so far as it goes is correct. It may be thus modified with advantage.

Calyx 5-sepaled: sepals united at the base, coloured within. Petals none. Stamens 5-10 or more, inserted on the tube of the calyx. Anthers cordate ovate. Ovary obovate truncated 1 or 2-celled, with a short placenta in the base, cohering to the dissepiment when 2-celled, and to the side of the cell when one-celled. Ovules attached to filiform podosperms. Styles one or two, simple. Capsule truncated 1 or 2-celled (cells afterwards divided transversely into two by a spurious partition) splitting transversely a little above the base: lid coriaceous containing one or two seeds enclosed by the spurious partition; bottom membranaceous with one or more seed. Seed pitted.—Herbaceous succulent plants &c.

Our *Glinus trianthimoides*, I have since ascertained does not, as we formerly hinted, belong to that genus but to *Orygia*, a genus first discovered in Arabia Felix, a point also ascertained by Professor Endlicher, who refers it to that genus. The following is the character of the genus—which it will be found corresponds accurately with the accompanying figure which was taken from growing plants gathered near Bellary.

Orygia (Forsk) calyx 5 parted persistent: petals numerous (about 20): ovarium free 5-celled with several ovules in each: styles 5 filiform recurved: capsule firm, chartaceous, globose, marked by five furrows opposite the partitions; dehiscence loculicidal: seed numerous somewhat reniform, testa crustaceous, furrowed; embryo annular curved round a farinacious albumen.

Herbaceous or suffruticose diffuse plants, leaves alternate, obovate, orbicular, or elliptic, succulent; cymes axillary and sub terminal opposite the leaves, elongated, dichotomously racemelike; calyx segments ovate cuspidate, membranaceous on the margin, patulous. Petals spatula to lanceolate entire about the length of the calyx white or purple: style and stigma filiform. Capsule 5-celled of a firm papery texture, smooth and shining externally, splitting from above along the middle of the valves between the partitions, the valves owing to the partitions tearing and remaining attached to the axis patulus: seed reniform testa furrowed black brittle.

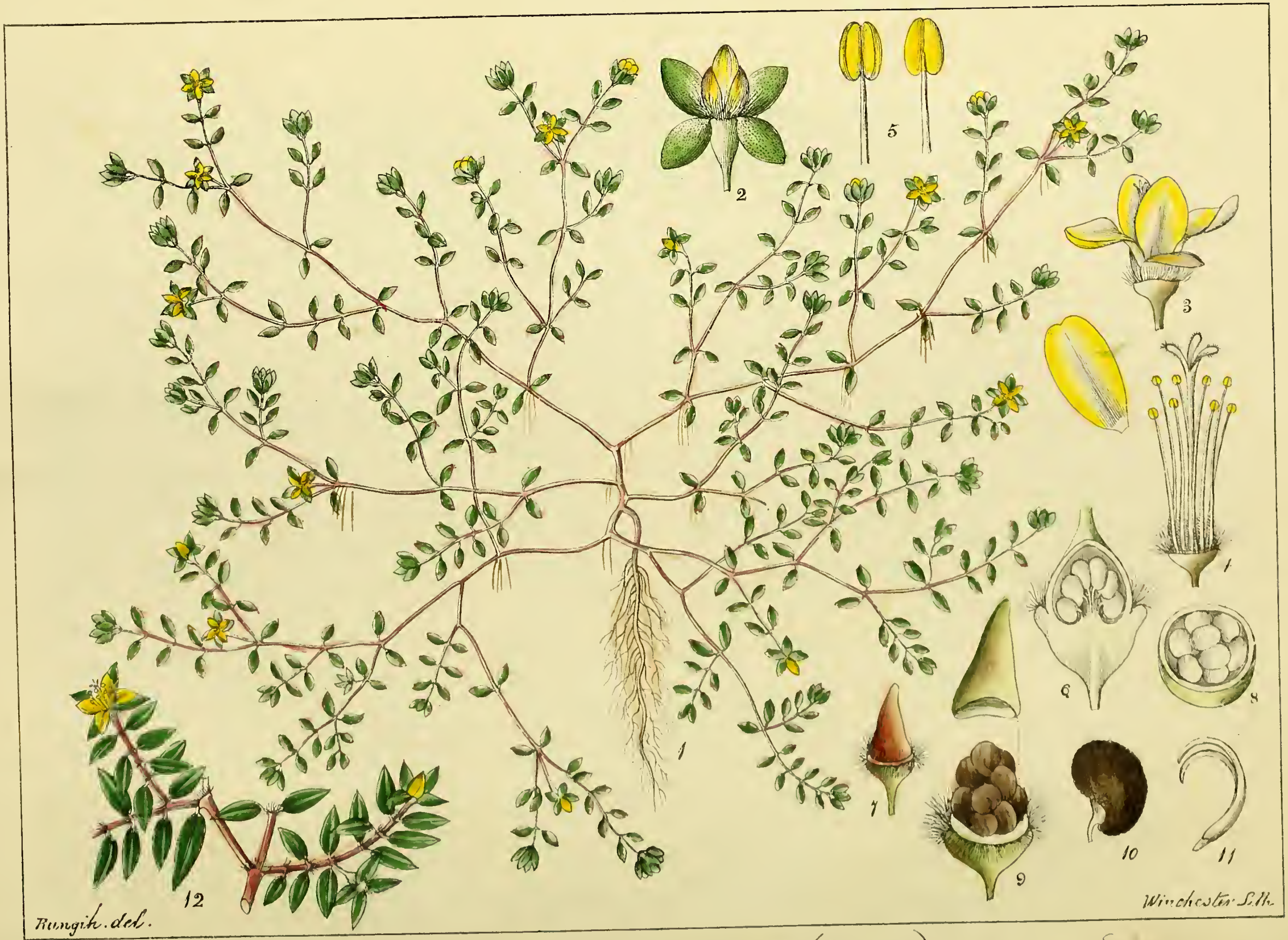
Polycarpæa.—The species of this genus are of difficult discrimination, if we attempt to distinguish them by the habit or shape of the foliage. Two species are named in our Prodromus. These after numberless attempts to distinguish I have finally been compelled to consider identical, scarcely even varieties. In room of the one thus reduced I have added two new species to the list. *P. diffusa*. and *P. spicata*. The former agrees in habit with *P. corymbosa*, but is at once distinguished by its lanceolate acute, not obovate obtuse petals and by the petals nearly equalling the sepals in length in place of being less than half the length.

P. spicata is readily distinguished by its slender form erect habit verticelled spathulate leaves and terminal spicate corymbs, that is, the peduncles divided into 4 spikelike branches of flowers. The sepals also differ from the others in being rough and coriacious in the middle with delicate membranous margins. The petals are linear lanceolate acute about half the length of the calyx.

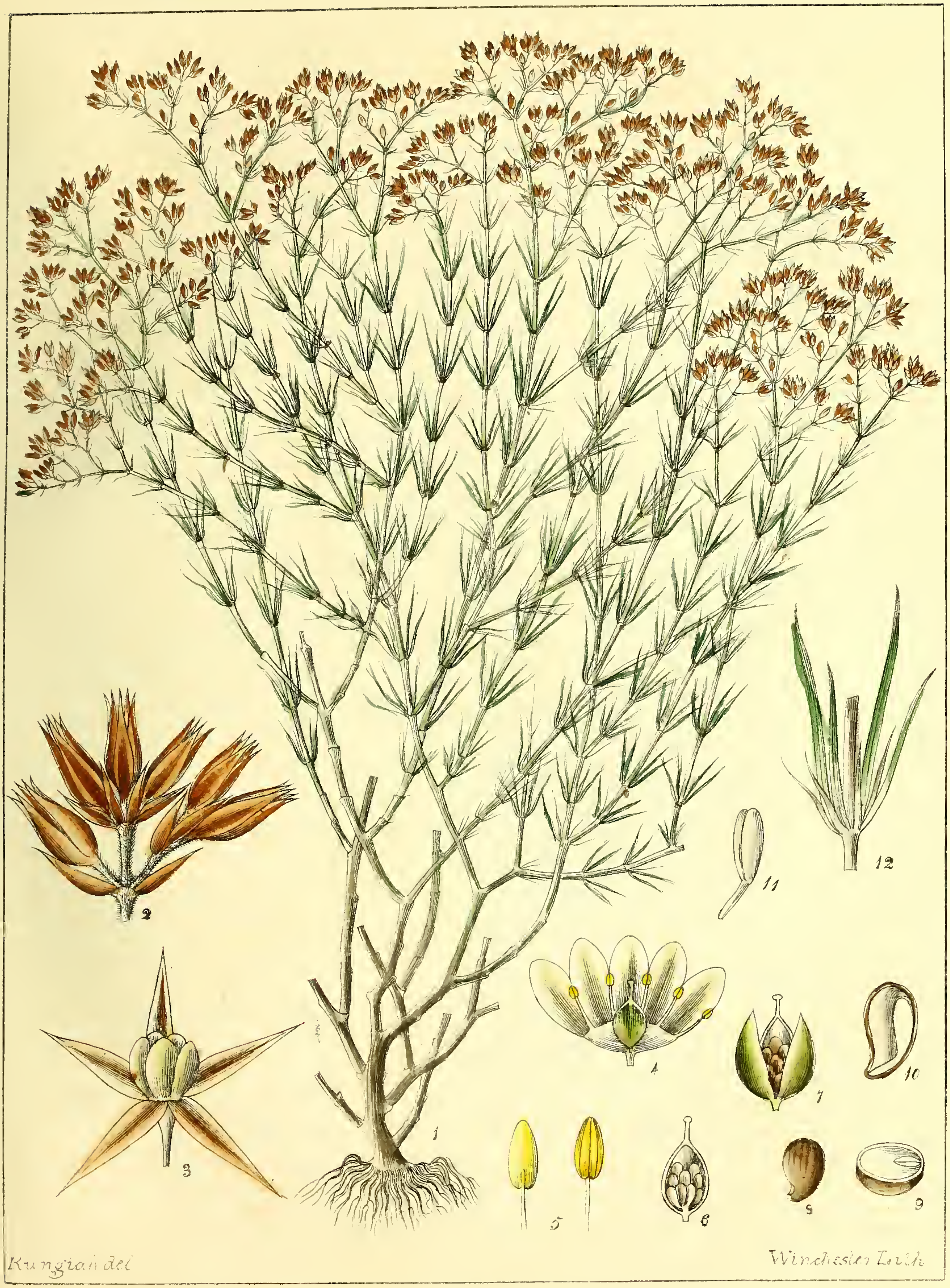
The following characters of these species were drawn up and published by Dr. Arnott in the Annals of Nat. History, Vol. 3, Pg. 91.

P. diffusa (Wight) " Suffruticosa ramosissima laxa diffusa glabriuscula, foliis fasciculatis linearibus, floribus cymoso—corymbosis, sepalis scariosis ovato—lanceolatis acuminatis enerviis, petalis sepala subæquantibus, stamina capsulamque acutam parum superantibus. *Hab.* Prope Tuticoreen (Maio 1835). *Wight.*

P. spicata (Wight) Glabra, radicle and collum multicipiti, caulibus plurimis gracilibus diffusis foliorum pedunculorumque fasciculos distantes 1-2 gerentibus, foliis radicalibus caulinisque fasciculatis glaucis subcarnosis spathulato oblongis acutiusculis, floribus imbricatis spicatis, spi-



PORTULACA QUADRIFIDA (LINN.)



POLYCARPÆA CORYMBOSA. VAR. AUREA

GLINUS TRIANTHEMOIDES (HEYNE.)

சாரணைபுணடு.

cis paucis ad pedunculi apicem fasciculatis, sepalis scariosis dorso uninerviis, petala subulata multo superantibus, filamentis basi dilatatis uno cum corollæ basi in annulum circa capsulam coalitis. *Hab.* in montibus Peninsulæ australioribus, *Wight.*

EXPLANATION OF PLATE, 109.

Portulaca quadrifida. Lin.
1. Flowering plant—*natural size.*
2. A detached flower before expansion, showing the 4 bracteal leaves with which it is surrounded.
3. An expanded flower, bracteas removed.
4. Petals and calyx removed to show the stamens and ovary.
5. Anthers.
6. Ovary cut vertically showing the central basilar placenta.
7. The same cut transversely.
8. A mature capsule.
9. The same the bed removed, showing the seed *in situ.*
10. A detached seed.
11. The embryo detached.
12. A small portion of a more luxuriant variety of the same species.

EXPLANATION OF PLATE, 110.

Polycarpaea corymbosa, Var—Ainea.
1. A small plant—*natural size.*
2. A panicle of flowers.
3. Sepals thrown back to show the petals.
4. Limb of the calyx removed and tube opened to show the insertion of the corolla stamens and ovary *in situ.*
5. Stamens.
6. Ovary divided showing the central placenta and ovules.
7. Capsule dehiscing.
8. A seed—
9. Cut transversely showing the embryo on one side.
10. The same cut vertically.
11. Embryo detached.
12. A joint of the stem leaves and bracteas.

EXPLANATION OF PLATE, 113.

Orygia trianthemoides.(Glinus trianthemoides Heyne.)
1. Flowering plant—*natural size.*
2. A fully expanded flower seen from above.
3. A detached petal.
4. Flower petals removed to show the calyx, &c.
5. An anther.
6 Capsule cut transversely.
7. A seed—
8-9. Different sections of the same showing the embryo carried round the mealy albumen.

LXXIV.—SURIANEÆ.

In our Prodromus Mr. Arnott viewing the genus Suriana as the type of an order, established this one on it. Two years after, Dr. Lindley taking a similar view, published it under the name of Surianaceæ but without the slightest notice or reference to the previously published name of Mr. Arnott. Why this omission ?

This order established on a single species is thus characterized by Mr. Arnott.

" Calyx 5-partite, persistent, æstivation twisted, imbricative. Petals 5, alternate with the sepals, distinct, inserted into the bottom of the calyx. Stamens 5, alternate with the petals, sometimes with 5 alternating ones that are occasionally abortive, all inserted with the petals : filaments persistent, distinct, subulate from a broad base, hairy below : anthers 2 celled, bursting longitudinally. Torus fleshy, filling up the bottom of the calyx, supporting the ovaries on its middle and the petals and stamens on its margin. Ovaries 5, opposite to the petals, 1-celled, distinct, each with a long style arising from the inner angle near the base. Ovules in pairs, collateral, erect, straight, with the foramen at the opposite extremity from the hilum. Fruit of 5 coriaceous pyriform indehiscent carpels. Seeds solitary, uncinate, attached to the base of the carpels. Albumen none. Embryo of the same shape as the seed ; radicle as long as the cotyledons, at the opposite end from the hilum : cotyledons oblong, fleshy, incumbent. Sea-side shrubs. Leaves simple, oblong-spathulate, thickish, pubescent, crowded at the apices of the branches, exstipulate. Flowers yellow, bracteated, somewhat terminal."

Affinities. Before offering an opinion of my own I shall first quote the remarks of both authors on this point.

" We scarcely know where to arrange the only genus of which this order is composed. Some refer it to *Rosaceae ;* Kunth proposes to place it near the *Geraniaceae :* we think it has

considerable affinity with the *Neuradeae*, of which *Grielum* has been alternately referred to *Rosaceae* and *Geraniaceae*, and that it may be left near them (a sub-order of *Ficoideae*) and *Crassulaceae*. We cannot see any resemblance to *Terebinthaceae*, with which DeCandolle arranges it. In some points it approaches the *Ochnaceae*."—Arn. W. and A. Prod. 1—361.

"I have intentionally constructed the foregoing character upon Suriana alone. If Heterodendron and Cneorum really belong to the same order, as DeCandolle (*Prod* 2. 1) suggests, the number of parts in the flower will vary from 3 to 5, the ovules will be sometimes pendulous (as in Cneorum) and petals will occasionally be absent (as in Heterodendron) Suriana itself appears, meanwhile, to be very near *Coriariaceae*, and also *Geraniaceae*, as Kunth has remarked. Its relation either to *Rosaceae*, or any *Terebinthaceae*, is not obvious."—Lindley's Nat. Syst. Edit. 2, pg. 142.

My materials for the examination of this plant are so imperfect that I am unable from them to prepare a figure of it, yet from their examination, imperfect as they are, I am induced to take a different view of its affinities from both of these eminent Botanists, and even doubt the propriety of constituting a new order for its reception. They appear to me to have allowed themselves to be misled, with regard to its affinities, by the double floral envelope and in consequence have overlooked its relationship with *Phytolacceae*, in the apocarpous species of which the styles are lateral as in Suriana. The genus *Gisikia*, with which I have compared it, corresponds accurately in the character of the ovary and fruit and even of the seed, for here also the albumen is sparing. The absence or presence of petals is not generally esteemed of much value as an ordinal character, at least if we may judge from analogy, as we very frequently find genera, differing in that respect, associated in the same order and occasionally species even in the same genus. *Gisikia* certainly differs in its less perfect flower, but at the same time it affords evidence that the imperfection is the result of suppression of parts, the stamens being alternate with the sepals, and still further, by the very dilated base of the filaments, which seem as if intended to supply the place of the corolla. In it the carpels are apocarpous, seated on a gynobase, with the styles springing from the base, the same as in Suriana and also *Bridgesia*, Hook. and Arn., which, it appears to me, is rightly referred by Mr. Don to *Phytolacceae*. For these reasons I would suggest for the consideration of Botanists who may be in possession of good materials, to re-examine this genus with a view to the solution of this question. In the mean time I conceive this view is strengthened by the suggestion of Dr. Arnott, that it may be a sub-order of *Ficoideae* which, according to his definition, may or may not have a corolla; but which, except in *Mesembrianthemum*, is not furnished with a gynobase, a structure which associates both that genus and *Suriana* with *Phytolacceae*.

Geographical Distribution. *Suriana maritima*, I believe the only species, is as the name implies a sea-side plant and is widely distributed, being found in South America, India, New Holland, New Caledonia, the South of Europe and the Canaries.

Properties unknown.

LXXV.—CRASSULACEÆ.

This though a large order, upwards of 300 of its species being defined by DeCandolle, occupies but a small space in the Indian flora: five species only so far as I know having as yet been found in the peninsula, for I have added none to our published list.

They are for the most part showy succulent plants, many of them great favourites in the flower garden on account of their wonderful capacity for resisting the extremest drought and heat of the dryest summers. The few found in India, though yielding in beauty to those of Europe and the Cape, are yet frequently cultivated as ornamental plants. The growing leaf (*Bryophyllum*) affords a good instance of this tenacity of life; suspended in the air, it will keep green for several weeks and in the mean time produce a crop of young plants from the glandular serra tures.

"Sepals 3-20, more or less united at the base. Petals equal in number to the sepals and alternate with them, inserted upon the bottom of the calyx, either distinct or forming a gamopetalous corolla. Stamens inserted with the petals, equalling them in number and alternate, or twice as many, those opposite the petals being shortest, and arriving at perfection before the

others : filaments distinct, subulate : anthers bilocular, bursting longitudinally. Nectariferous scales (abortive stamens), one at the base of each ovarium, sometimes obsolete. Ovaria equal in number to the petals, and opposite to them, 1-celled, and tapering each into a short style, distinct, or slightly connected at the base. Fruit of several follicles, opening by the ventral suture. Seeds variable in number. Embryo straight in the axis of thin, fleshy albumen : radicle pointing to the hilum. Leaves succulent (or very rarely membranæceous), entire, or pinnatifid, exstipulate."

Affinities. DeCandolle places this order between *Portulaceae* and *Paronychiaceae* on the one side and *Ficoideae* on the other, but if the views I have ventured to promulgate respecting the affinities of these three orders prove correct, this one must of necessity be removed from that station. Assuming that they are correct, and that the series of peripetalous calyciflorous orders is to be re-arranged, I would suggest that *Crassulaceae* and *Saxifrageae* should stand next each other, as being really the most nearly allied of the series, that *Cacteae* and *Grossulaceae* be placed near *Myrtaceae* followed by *Passifloreae* and *Papayaceae* as having the inferior ovary of those preceding and the parietal placentas of those following. *Crassulaceae* and *Saxifrageae* might follow these, being associated with them by their superior, or only half inferior ovary, but separated on either side by their central placentation, while they approach each other by the introflexed margins of their carpels, and straight embryo in the middle of a more or less copious fleshy albumen. The *Cur embryose* orders, all of which have free ovaries, would then conclude the series. The free polyspermous apocarpous ovaries and perigynous flowers of *Crassulaceae* sufficiently distinguish them from all others.

Geographical Distribution. The Cape of Good Hope is unquestionably the head-quarters of the order, nearly one half of the species being natives of that country. The Canaries seem to hold the second place, there being 18 found in these Islands, while the whole of Europe only gives 52— DeCandolle assigns three only to India and 4 to China and Japan, some further acquaintance with these countries will probably greatly enlarge that list as it has already done in India by the discovery of about 30 on the Himalayas. This fact in addition to those stated above, show that the high heat of the tropics is unfavourable, but that they prefer the warmer climates bordering on them. Their habits and power of enduring exposure to heat and dryness, as above remarked, is very peculiar.

" They are found in the dryest situations where not a blade of grass or a particle of moss can grow, on naked rocks, old walls, sandy hot plains, alternately exposed to the heaviest dews at night and the purest rays of the noonday sun. Soil is to them a something to keep them stationary rather than a source of nutriment, which in these plants is conveyed by myriads of mouths, invisible to the naked eye but covering all their surface, to the juicy beds of cellular tissue which lie beneath them" (Lindley). The truth of these opinions is strongly corroborated by the observations of Botanists in attempting to dry them. Instances are on record where species of these plants have been known to continue for months and even years in a state of insipient vegetation in the Herbarium.

Properties and Uses. Little is known regarding their properties. The stone crop of Europe (*Sedum acre*) and some others are known to possess considerable acrimony but generally they are considered refrigerent and detergent. They have not been used medicinally.

Remarks on Genera and Species. Only two genera are known in this portion of India containing between them only 5 species, and two of these, *Kalanchoe florebunda* and *K. heterophylla* not well known.

This I am enabled to state from finding my specimen of the former, consisting of two fragments,containing two species. Most probably one of them is *K. heterophylla*, but which is not easily determined, Roxburgh's character of that species being so loosely constructed that it might include the whole. Retaining therefore our character of *K. florebunda*, which applies to only one of the two, I shall adopt Roxburgh's name for the other, which is at once distinguished from the rest by the sepals, which in them are free to the base, but in this cohere two thirds of their length, forming a somewhat campanulate inflated calyx, ending abruptly in a point, and like all

the upper part of the plant, clothed with viscid pubescence. The flowers are of a light brownish pink, and very numerous.

The plant figured gives a very imperfect idea of the species, which often attains a large size, but was selected on account of its diminutive growth rendering it so suitable for the purpose. All the species abound in Mysore, especially *K grandiflora* which is found every where.

EXPLANATION OF PLATE, 111.

Kalanchae grandiflora. Wall.
1. A small plant, *natural size.*
2-3. Dissected flower.
4. Stamens.
5. Pollen.
6. An ovary cut longitudinally.
7. Cut transversely.
8. A portion of a carpel, *more highly magnified.*

LXXVI.—CACTEÆ.

Some Botanists consider it doubtful whether the only species of this order, so common in India, be really indigenous, and owing to our considering it identical with an American species we have attached a mark of doubt in our Prodromus. If really introduced, the introduction must have taken place a great many years ago, as it is now found apparently indigenous all over the country. One circumstance which I have often remarked, as in favour of its introduction, is, that I have never, so far as my recollection serves me, met with it far from the habitations of man, while other similar plants decidedly indigenous, such as the large Euphorbias, are met with in the most remote situations, such as scarcely leave room to suppose were ever inhabited. This remark is introduced principally in the hope of its calling attention to the circumstance, and eliciting facts and observations tending to set this question at rest.

This order is a very curious one, especially as regards the habits of the plants composing it, here we have the flat leaf shaped stems of *Opuntia*, the triangular-winged ones of *Cereus*, the cord like ones of *Rhipsalis* and the lumphy melon-shaped ones of *Melocactus*. The flowers are for the most part conspicuous, with such a gradual transition from calyx to corolla that it is not always easy to tell which is which.

" Sepals numerous, usually indefinite and confounded with the petals, either crowning the ovarium or covering its whole surface. Petals numerous, usually indefinite, sometimes irregular, inserted at the mouth of the calyx. Stamens indefinite, cohering more or less with the petals and sepals : filaments long, filiform, anthers ovate, versatile. Ovarium fleshy, cohering with the tube of the calyx, 1-celled, ovules indefinite : style filiform, stigmas several. Placentæ parietal, as many as the stigmas. Fruit succulent, 1-celled. Seeds many, after having lost their adhesion nestling in a pulp, ovate or obovate. Albumen none : embryo straight, curved or spiral : radicle thick, obtuse, next the hilum. Succulent shrubs. Leaves almost always wanting, when present fleshy, smooth, entire or spiniform. Flowers sessile."

Affinities. Up to the publication of the 2d edition of Lindley's Natural System of Botany, *Cacteae* and *Grossulariae* were considered so nearly allied, that it was said they were separated more on account of their difference of habit than for any really important difference of structure between the two ; the definite stamens and albumenous seed of the latter, not being esteemed of sufficient weight of themselves to distinguish them, had not the very dissimilar appearance of the two sets of plants aided the division. Such, as I understand them, were nearly Lindley's views, as explained in the first edition of his work. In his second he takes a different view, and probably a more correct one, when he says that " the true affinities of *Grossulaceae* are of another nature and are best indicated by the excess of albumen in the seed" which being wanting in Cacteæ indicates the want of affinity between these orders.

To this reasoning I am willing to subscribe, when more systematically acted upon. I have already (under *Portulaceae*) expressed an opinion that, properly studied, it seems not improbable we may yet be enabled to construct our secondary as well as primary groups on characters taken from the structure of the seed, but before we can arrive at that point it seems indispensable, that we should assign a constant not a fluctuating value to the same structure in different families, that is not to give it a very high value in one case and a very low one in another. This I conceive Dr. Lindley has done in the construction of his groups. The presence of albumen

KALANCHOE GRANDIFLORA (WALL.)

in large quantity is essential to the admission of a family into his first group of polypetalous plants, but in all his subsequent ones this, the essence of his first, is sacrificed to the free or adherent ovary, or the parietal or axillary position of the placentas, and these again in turn give place to some other point of structure that might for the time happen to assume greater or less importance in the author's estimation. By thus assigning different values at different times to the same organs, Dr. Lindley has, I conceive, totally failed in the construction of a Natural System of Botany.

Exogens have, with a few rare exceptions, dicotyledonous seed, Endogens monocotyledonous ones, Acrogens are acotyledonous, hence the foundation of this system is essentially seminal being based on seminal structure. Why then,in the distribution of these primary classes into minor subdivisions or groups, have recourse to other organs, and these too of the most unstable kind, the presence or absence of one of the floral envelopes, or the union or freedom of its parts, when he could equally well, if not better, have supplied himself with secondary characters from the same organ that gave the primary—the seed?

In the discussion of the Affinities of almost every order reference is made to the structure of the seed, whether albumenous or exalbumenous. Assuming that this character possesses the high value assigned to it, and I believe it does, a much better distribution would have been into secondary groups depending, *not upon the flowers being polypetalous, monopetalous* or *incomplete*, but upon the seed being exalbumenous, albumenous or sub-albumenous. By this course the high value originally attached to the structure of the seed would have been preserved and a uniform value assigned to its modifications. Characters taken from the flower would then, by having an equally uniform value assigned but of only secondary, in place of primary importance, have become much more useful in practice. Had this course been adopted I should at once have subscribed to the separation of these orders, but so long as our arrangement depends for its primary divisions not on the albumenous or exalbumenous structure of the seed, but on the structure of the flower, I cannot subscribe to the logic of separating two orders closely associated by their floral arrangement because they differ in their seminal formation. For these reasons, which I have stated in detail because I think they involve an important principle in our attempts to construct a natural system of plants, I cannot adopt the reasoning of Dr. Lindley in separating these two orders. I have already under *Ficoideae*, indicated the place which I think the order ought to occupy on account of the structure of their fruit, without reference to that of the seed.

Geographical Distribution. Nearly the whole order are natives of America, those found in other countries are so generally naturalized plants that it is justly doubted whether there is one exotic to America.

Properties and Uses. On this subject nothing very important is known. The fruit of some of them are eatable, that of *Cactus opuntia* being highly esteemed all over the South of Europe, where it is known under the name of Indian Fig It is a fruit of easy digestion and on account of the acidulous saccharine juice with which it abounds, is considered refreshing and very cooling. Some years ago the succulent stems of the same species were much employed in this counry as a vegetable and as such were largely supplied to the shipping frequenting the port, as a means of preventing scurvy among the sailors, for which, its property of long remaining fresh and green admirably qualifies it. Of late years it has fallen into total disuse, perhaps from the facility of procuring more palatable ones.

It is narrated that the leaf-like stems of the common hedge Cactus when split through the middle and applied to the skin acts in a few hours as an effectual rubifacient, and is recommended as a remedy against gout, tooth-ache, &c. Dr. Cleghorn relates that in Minorca, he was in the habit of applying it to the chest in cases of Pluerisy, and with much relief to his patients. Similarly prepared it is applied to painful corns for the purpose of taking them out by the roots. This it effects by keeping them bathed in moisture for several days which completely destroys them. A piece of adhesive plaster kept over a corn for several days produces the same effect, by retaining the perspiration on the part. Directly, this order contributes but little to either the necessaries or luxuries of life, but indirectly, it does so extensively, by supply-

ing the food on which the cochineal insect lives. This very valuable little creature of which nearly 400,000 lbs. weight are annually imported into Great Britain is entirely reared on plants of this order, though up to the present time it is uncertain what species has the preference, two or three being named on which it has been reared in different situations with greater or less success. The *Cactus* or *Opuntia* (as DeCandolle prefers designating it) *Toona* being said to have the preference and not C. *cochinillifer*, which Linnæus believed to be the true cochineal plant.

The importance attached to the possession of this insect may be estimated from the fact of the East India Company having offered a reward of £2000, Dr. Ure says £6000, to any one who succeeded in introducing it. Stimulated by so large a reward various attempts have been made but hitherto without success; the last was made by the Agricultural Society of Bengal. On that occasion, the prospect of success was at one time considered so certain, that it actually became a subject of discussion among the Members whether the Society was not entitled to claim the reward offered by Government, but it like all its predecessors failed. Though it seems very desirable to have among us a branch of industry that returns a profit to the Mexican cultivator, the importance of it has been greatly diminished of late years by the great fall in the price of the article.

At the time the reward was offered, its market price was upwards of £1-10 the pound, since then it has fallen to 8 or 10 shillings and the market is fully supplied at these prices, though so low that nothing but extreme cheapness of labour and the perfect facility acquired by long practice in the management of this branch of industry could enable them to cover the cost of production, such being the present state of the case, the value of the object sought to be obtained is so greatly reduced that it seems scarcely to merit further attention, except on the chance of the article rising in value under a recurrence of the circumstances which first gave rise to it, which though quite possible does not seem probable.

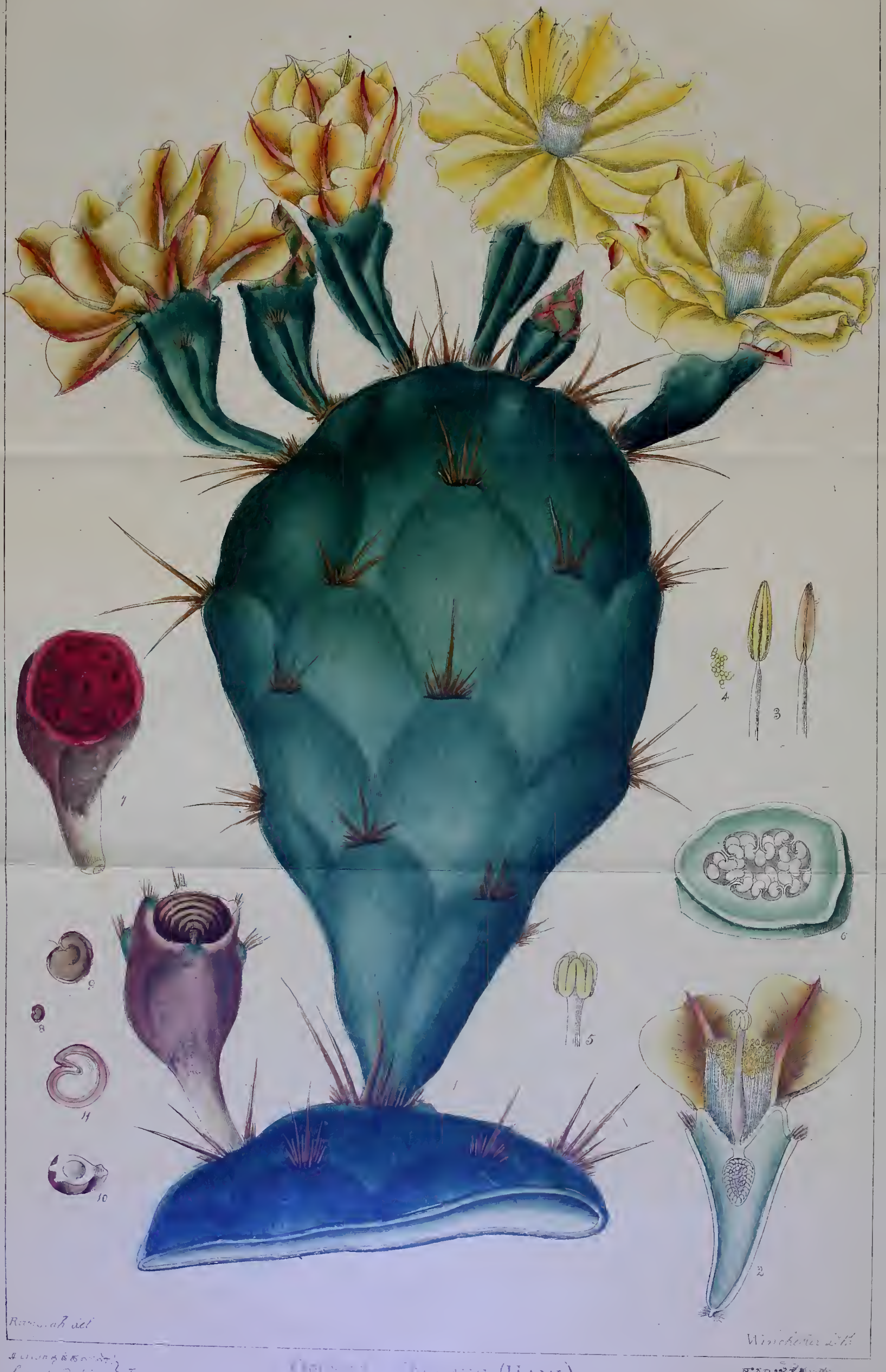
EXPLANATION OF PLATE 114.

Cactus Dillenii. (Haworth).
1. Flowering branch, *natural size.*
2. Flower cut vertically, showing the position of the ovary.
3-4. Stamens and pollen.
5. Stigma.
6. Ovary cut transversely.
7. Mature fruit.
8. A seed, *natural size.*
9. Magnified.
10. Cut transversely.
11. Cut longitudinally.

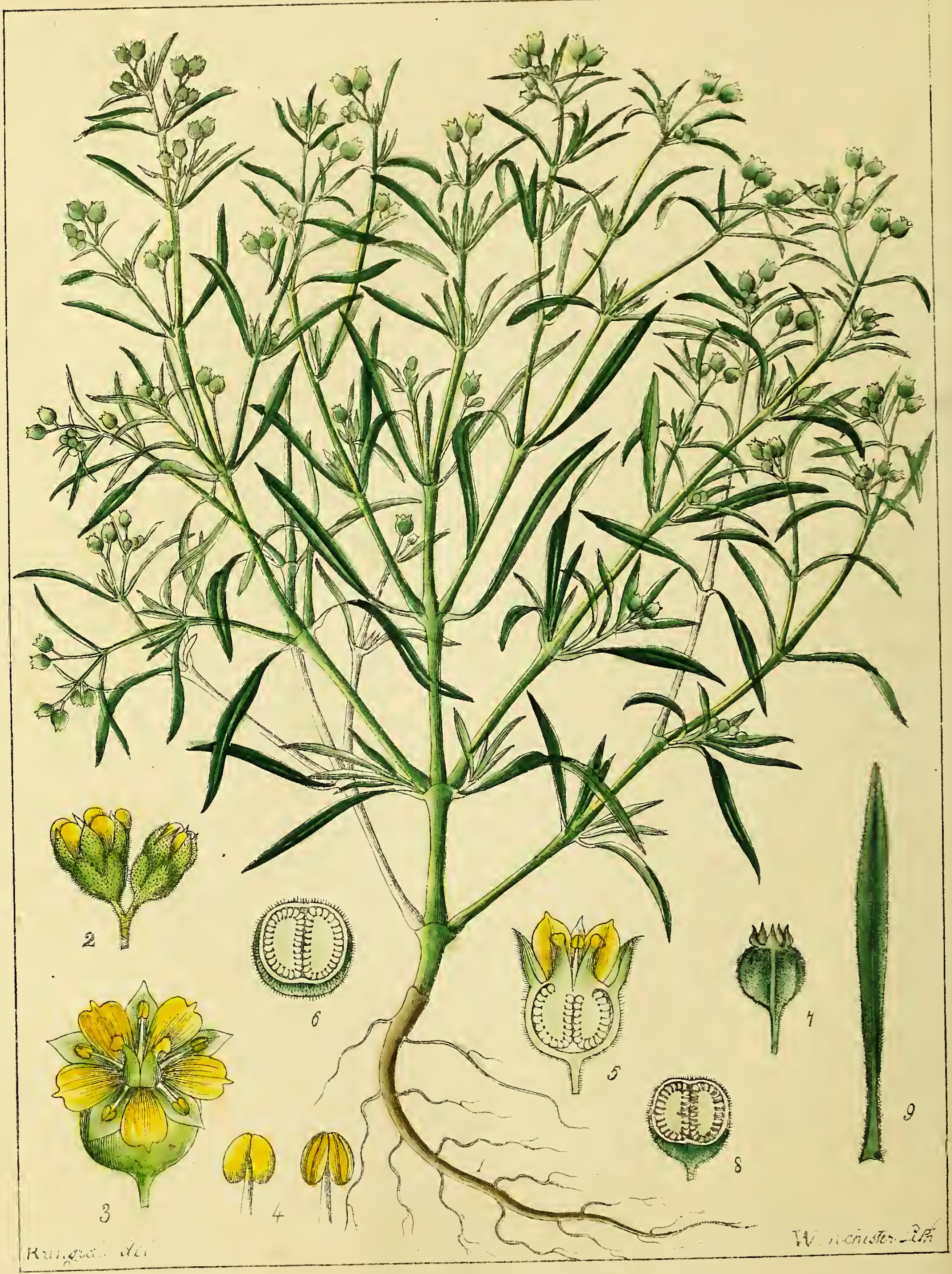
LXXVII.—SAXIFRAGEÆ.

On this order, so little known in tropical countries that two species only have yet been found in Southern India, it seems scarcely necessary to dwell at any length. The only species I have seen, natives of India, are two lowly weeds with nothing either in aspect or properties to recommend them to our attention. On the Himalayan mountains the case is otherwise, for there, many species, appertaining to several genera, have been found. This order though of very limited extent in the warmer regions of the earth, is of some magnitude in temperate ones, and from the varying forms included under it, one of considerable complexity, at least as viewed by DeCandolle whose character we have adopted and which I repeat here in the hope of its aiding in the detection of new Indian forms.

" Sepals usually 5 (rarely 3, 4, 7, or 9), more or less cohering at their base: the limb usually persistent. Petals as many as sepals (except in *Donatea*) inserted on the tube of the calyx, alternate with its lobes, deciduous or persistent, very rarely wanting. Stamens perigynous, either equal to (or rarely fewer than) the petals, and alternate with them; or twice as many as the petals, some alternate, some opposite to them (in one species, by the abortion of the alternating stamens, there are only 5, and opposite to the petals; or (in *Bauera*) indefinite: filaments subulate; anthers ovate, 2-celled, bursting longitudinally or (in *Bauera*) by two pores. Ovarium partly coherent with the tube of the calyx, formed of two (rarely 3 5) carpels, cohering by their introflexed sides or margins: styles as many as the carpels, distinct, or more or less combined: stigmas capitate or clavate. Placentae along the introflexed margins of the carpels, either throughout the whole length, or at the base only, or at the apex, usually separating with the carpels, rarely attached to a central axis. Fruit capsular, usually of two (rarely 3-5) carpels or valves, the margins of which are either entirely, or partly introflexed, or scarcely



(HAW.)



VAHLIA OLDENLANDIOIDES (ROXB.)

at all and the fruit is then 1-celled: carpels dehiscing at the ventral suture, separating from each other, either from the base upwards, or from the apex downwards. Seeds usually numerous, rarely definite: albumen fleshy. Embryo small, in the midst of the albumen: radicle pointing towards the hilum."

Affinities. Much difference of opinion exists on this head, which seems to indicate that the order as now constituted is not a very natural one, and it certainly affords an instance of the difficulty of establishing natural groups according to the floral organs, some of the genera referred here having superior, some inferior, or sub inferior flowers and some have two, some three, and some 5-celled ovaries. The seed however are always albumenous. Under *Cacteae* I directed attention to the circumstance of Dr Lindley removing *Grossulariae* to a considerable distance from that order, on account of its albumenous seed though associating in its floral characters, as an instance of attaching a high value to that character in one instance while in others he assigned it a very secondary one, we have another instance of the same kind here. The genus *Parnassia*, though differing in having a free one-celled ovary, parietal placentas, and exalbumenous seed, he places here, on the supposition that its fringed scales are a peculiar development of a hypogynous disk. This view of the nature of these scales may or may not be correct, but if the presence of albumen is to have so much importance attached to it in one instance, ought we so totally to disregard it in another, as to place a plant, differing so materially both in floral and seminal structure, its seed being exalbumenous, in an order the character of which is to have "the embryo in the axis of a fleshy albumen? My acquaintance with both *Saxifrageae* and *Crassulaceae* is limited, but so far as it extends, these two seem to be most nearly allied orders, differing principally in the more or less complete union of the ovary with the calyx, and the number of carpels, points, in which different genera of each order meet, while they equally associate in the structure of their seed.

Between them and *Grossulariae*, the affinity is small indeed, and is equally remote from *Umbelliferae*, to both of which DeCandolle adverts as relations. Between the section *Hydrangeae* and *Philadelpheae*, I have already indicated such an affinity as appears to warrant their union, but as my acquaintance with both is slight, I merely suggest the affinity, leaving to those better informed either to unite them, or show that in this supposition I am in error: the fact however of DeCandolle placing *Deutzia* here, while all other writers associate it with *Philadelphus* is in favour of my suggestion.

Geographical Distribution. The species of this order are nearly all natives of northern latitudes, and several are found within the arctic circle, most of them are natives of Mountainous tracts in Europe. The following brief extract from Lindley's Natural System of Botany gives a good idea of their habits and the kind of stations they prefer.

"Little elegant herbaceous plants, usually with white flowers, cœspitose leaves, and glandular stems: some of the species have yellow flowers, others have red, but none blue. They are natives of mountainous tracts in Europe and the northern parts of the world, frequently forming the chief beauty of that rich turf which is found near the snow in high Alpine stations. Some grow on rocks and old walls, and in hedge-rows, or near rivulets, or in groves."

Properties and Uses. Astringency is the predominating peculiarity of the order, whence an American species has received the name of alum root.

Remarks on Genera and Species. Only one genus has yet been met with in Southern India. It is one of those having the placenta pendulous from the apex of the cell of the ovary. Only two species belong to it, both obscure weeds having neither use nor beauty to recommend them to notice. They abound in sandy soil on the banks of rivers and near the sea coast.

EXPLANATION OF PLATE 115.

Vahlia oldenlandioides. Roxb.
1. A plant, *natural size.*
2. Flowers side view.
3. Front view of the same, *more highly magnified.*
4. Anthers back and front view.
5. Ovary cut vertically, showing the pendulous placentæ covered on all sides with ovules.
6. Cut transversely.
7. Mature capsule.
8. Cut transversely.
9. A leaf, *magnified.*

CLASS 3D CALYCIFLORÆ EPIPETALÆ.

" Torus lining the tube of the calyx and forming at its extremity a small disk (epigynous) on the summit of the ovary which coheres with the calyx tube. Petals distinct and with the stamens inserted on the outside of the disk."

In our flora two orders only are referred to this class, *Umbelliferae* and *Araliaceae ;* a third *corneae*, the only other, is also found in the northern parts of India, Wallich having discovered two handsome species of *cornus* in Nepaul, and Blume 5 in Java.

LXXVIII.—UMBELLIFERÆ.

A large and most natural order, but at the same time by far the most difficult we have yet had to encounter, whether our object be to dispose of its genera into suborders and tribes, or its species into genera and sub-genera. Various indeed are the efforts which, from the days of Linnæus to the present, have been made systematically to distribute the species of this order, but each in its turn has been found wanting in some particulars, in proportion as our knowledge extended, and at this moment, two arrangements contend for the palm of adoption by future Botanists.

Linnæus viewed the umbel as a sort of compound flower with a branched in place of solid receptacle and considered the involucrum as a sort of exterior calyx. Observing that most species had a double umbel, these, he designated *univeral* and *partial* umbels. The first consisting of several rays springing from the apex of the branch, each of which again terminated in a smaller umbel of flowers forming the second. Further observing, that some species had involucres at both, some at the second only, and some at neither, he, with his usual tact, availed himself of these simple and easily observed distinctions to distribute the 44 genera which he knew into three principal groups. His first division including all those with both universal and partial involucres his second all those with partial only, and his third those having neither. His generic characters were then taken from the flowers, the involucrum and form of the seed. Sprengel, whose system next claims attention as being that which has met with most support, forms his sections on the seed, 1 compressed flat—2 rather solid winged—3 fruit bladdery—4 fruit coated—5 fruit armed—6 fruit solid, naked—A variety of secondary characters are afforded by the involucra the *costae* and the intermediate furrows of the seed, whether with or without *vittae*, &c. Professor Hoffman, of Moscow, proposed another arrangement the sections of which are founded on the seed and petals—seed furnished with, or without, *vittae*—whether the *vittae* are epicarpous or epispermous—whether the *vittae* are on both the dorsum and commissure or on one or other, &c. The generic characters are taken from the involucrum, petals, seed, and the number of *vittae* between the *costae*, &c.

These have successively given way to the arrangement of Koch and DeCandolle, which seems now almost universally adopted—though not unquestioned, as a more recent arrangement has been proposed, the peculiarities of which will be noticed in the proper place.

Enough has here been said, though but a fraction of what might have been, to show how much this order has engaged the attention of Botanists, and to prove how difficult it must be to chalk out a just arrangement, since all that has yet been attempted must to a greater or less extent be considered failures, except, perhaps, the last and that remains to be ascertained, as no qualified Botanist seems yet to have examined it critically.

The plants of this order, which exceed 1000 species are nearly all herbaceous, some are suffruticose but none either shrubs or trees. The stems of the larger ones are frequently hollow others are filled with a large Medulla or Pith, with thick fibres scattered through it like the stems of monocotyledonous plants. The leaves are almost always alternate, variously divided, and sheathing at the base. The flowers are umbelled, the umbels either perfect, that is, having both general and partial umbels, or imperfect that is simple, or capitate, or dichotomous, or irregularly divided. The involucra are equally variable hence they have been employed to supply sectional, generic and specific characters, which the flowers, owing to their uniformity of form throughout the order were supposed less fitted to supply.

" Calyx 4-toothed, or entire. Petals 5, inserted on the outside of a fleshy disc, around the top of the ovary, alternate with the teeth of the calyx, often inflexed at the point, the inflex-

ed portion cohering with the middle vein of the lamina : aestivation somewhat imbricate, rarely valvate. Stamens 5, alternate with the petals, distinct, folded back during aestivation, anthers ovate, 2 celled, dehiscing longitudinally. Ovarium cohering entirely and closely with the calyx, crowned by a fleshy disc (an expansion of the torus) 2-celled : ovules solitary, pendulous : styles 2, simple, their bases more or less thickened and fleshy (*stylopodia*), covering the disc and top of the ovary : stigmas simple. Fruit dry (a *cremocarpium*) consisting of two carpels (or *mericarpia*) which adhere by their face (*commissura*) to a common axis (*carpophorum*), but in maturity separate from it, and are pendulous : each mericarp indehiscent, traversed by 5 longitudinal primary ridges (*juga primaria*), one opposite to each petal and each stamen and often also by alternating secondary ones (*juga secondaria*), the ridges being separated by channels or interstices. In the substance of the pericarp are linear ducts or canals (*vitta*) full of an oily or resinous matter, these are usually lodged in the interstices, sometimes below the ridges, rarely wanting. Seed pendulous, usually cohering with the carpel, rarely loose. Embryo minute, at the base (that is, at the apex of the fruit) of a copious horny albumen : radicle superior, pointing to the hilum. Herbaceous or rarely suffrutescent plants : stems usually fistular and furrowed. Leaves alternate, very rarely opposite, simple (without articulations), variously cut, sometimes reduced to the petiole (*phyllodium*). Flowers in umbels, the umbel sometimes capitate, usually with an involucre."

Affinities. These are not of easy determination and are I think still to be discovered. If we attempt to determine their affinities by their floral arrangement and general habit they come well after *Saxifrageae*, but if we look principally to the ovary and seed for ordinal characters their affinity with that order is remote, while with *Ampelideae*, through *Araliaceae* they become closely approximated. *Ranunculaceae* by agreeing in the highly albumenous seed and in general habit are also allied both directly, through *Ranunculus* and *Thalictrum* on the one side, and *Pimpinella, Scandex*, &c. on the other, and indirectly through *Clematis* and *Aralea* which have many points of resemblance. The affinity between these two orders is strongly insisted on by Lindley who observes, " if we consider fairly the respective organization of *Ranunculaceae* and *Umbelliferae* especially of such genera as *Thalictrum* in the one and *Pimpenella* in the other, we shall find that *no positive mark* of discrimination between them can be pointed out, except the superior carpels of the former and the inferior ones of the latter ; for the indefinite stamens of *Ranunculaceae* are no longer capable of forming a distinctive character since the discovery of *Casalea*. As for *Thalictrum faeniculaceum* any one would take it for an umbelliferous plant without attentive observation. Now it is impossible to acknowledge any system to be natural in which, under these circumstances of almost identity of structure and sensible properties two such orders are disjoined ; and I consider the restoration of *Umbelliferae* and *Ranunculaceae* to their relative positions one of the strongest arguments in favour of the necessity of this albumenous group."

I quote this passage not for the purpose of opposing the views of the author, though I do not altogether adopt them, but in confirmation of my remarks under *Cacteae* and as showing that Dr. Lindley by adopting and acting on the opinion that " no division of Exogens has been discovered more in accordance with natural affiiities than that which depends on the different degree of development of the flower" while he in his first by group employing one altogether at variance with its principles has thereby produced associations equally if not more unnatural than those which he proposes to remedy and forms a system greatly inferior to them in facility of application to practice. By this mixing of systems there are no fewer than 175 orders interposed between *Umbelliferae* and *Rubiaceae* (*Cinchonaceae* Lind.) and 177 between it and *Caprifoliaceae* though in both these we find the copious albumen of his *Albumenous* group and in the latter occasionally polypetalous flowers. Looking therefore to the primary structure, that of the seed, and to the epigynous flowers of these two orders, I cannot but think the affinity between them and *Umbelliferae* is much closer than between it and some of the other alliances associated in his group *Albumenosae*. Had the principle been adopted, of associating as a class all the orders distinguished by having highly albumenous seed, to be afterwards divided into subclasses according to the flowers, we should not have had to complain of the incongruity of assigning to two sets of organs wholly incompable with each other, high values in one place and very low ones in another. Many instances of this could be adduced but

of which I shall content myself with one ; *Lygodiaceae* an exalbumenous order is placed in the same alliance with *Cynchonaceae* a pre-eminently albumenous one. He states that some of the connecting links of his albumenous group are evidently wanting, this is not to be wondered at when some of the primary ones are excluded because of their having monopetalous or apetalous flowers. But let us place every known order having the " embryo considerably shorter and smaller than the albumen" together, without reference to the flowers which in comparison with the seed are variable, and reconsider the whole when it seems not improbable the missing links will be found, and the true affinities of this very curious and difficult order made out. This assuredly is not the case now, otherwise, I cannot suppose *Geraneaceae* an exalbumenous hypogynous order would be referred to as a relation in consequence of the cohesion of the carpels round a woody axis, since, at this rate, they are equally allied to *Euphorbiaceae*, with the additional advantage of both having albumenous seed. Here I quit the subject of its affinities having said enough to show that the question is still *sub judice* and requires a master mind to unravel it.

Geographical Distribution. I had almost said *fortunately*, for Indian Botanists, this order occupies but a very secondary place in the Indian Flora, the species being chiefly natives of more temperate climates, where they inhabit groves, thickets, marshy places, plains and waste grounds. The few species found in Southern India are chiefly met with on the highest hills or the skirts of dense jungles, a very few only being found on the open plains and these principally in rich arable lands. In northern India they are more frequent especially on the Himalayas, whence Dr. Royle informs us he has no fewer than 90 species, which, added to those from other parts of India make a total of 127 Indian ones. Though *Umbelliferae* abound more in the Northern than Southern hemisphere, the latter is not deficient, something less than one-third of those known being found in the temperate portions of the South, but they are much more numerous in the old than the new world. Being so exclusively an extra tropical order it is not one meriting much consideration of the tropical Botanist beyond showing that wherever a number of species are found native within the tropics, the station may be considered one enjoying a low mean temperature and thoroughly adapted for the growth of extra tropical plants requiring for their successful culture a temperate climate. The same fact shows on the other hand that, being generally plants impatient of high temperature, there seems little chance of successfully cultivating any of the extra tropical species within the tropies, except during the coolest season of the year.

Properties and Uses. The properties which distinguish this family are very various and, according to the part under examination, of the most opposite kind : those appertaining to the seed being for the most part aromatic and mildly stimulant, and scarcely in any instance poisonous ; while those of the vegetation are generally acrid,very often virulently poisonous and except when ameliorated by culture always suspicious. A few only are employed towards supplying food for man or cattle. The Carrot, Parsnip, Skirret, Parsley, Cellary, Samphire, Arracacha and Earth-nut (*Buneum Bulbocastanum*) about complete the list of those eat by man ; the Prangos hay of Cashmere is one of the very few used as fodder for cattle. The Materia Medica is however largely indebted to this order, some of our most esteemed Carminitives being derived from it, as well as some powerful narcotic remedies, among these perhaps the best known is the Hemlock, which has been long in use for the relief of Cancerous affections and occasionally as a local application for the cleaning of foul ulcers, though for this last purpose the Carrot is in more general use. Caraway, Coriander, Dill Anise, Fennel seed are all used as Carminitives and gentle stimulants in Europe and India. The Ajawan and some others are esteemed here though less known elsewhere. Besides these we are indebted to this family for several other useful medicines, such as Assafœteda, Opoponax, Galbanum, Sagapinum, and it is supposed Gum Ammoniae, one of our best expectorants and applied as a plaster to indolent tumours and chronic boils, an excellent deobstruent. Dr. Paris recommends it in combination with Rhubarb as a useful medicine in Mysenteric affections by correcting viscid secretions.

DeCandolle seems to think that the very opposite properties found in this family may be explained by supposing that the extractive matter is narcotic and acrid, while the resinous matter is stimulant and aromatic, which in other words is, by supposing

their juice, while yet only half elaborated is narcotic, but becomes aromatic and stimulant when it is transformed into the true resinous sap. According to this hypothesis the roots having much mucilage and water and little extractive, ought not to be poisonous and therefore fit for the food of man. This we find the case in many species though certainly not in all, (for we know that the roots of some are very poisonous) but still often enough to afford much evidence in support of his doctrine. In the juices of the herbaceous part of the plant, the green portion, where extractive abounds and can be easily extracted either by infusion or decoction in water, we find concentrated, the narcotic and poisonous properties of the Hemlock (*Conium maculatum*), Cowbane (*Cicuta virosa*), the Dead tongue (*Ænanthe crocata*), Fools Parsley (*Æthusa cynapium*), &c., while the proper sap such as flows spontaneously from wounds in the bark or otherwise is resinous tonic and aromatic. According to this theory tinctures prepared with pure alcohol, which does not dissolve extractive, should not be narcotic and poisonous, whereas we find both Dr. Christison and Mr. Pereira recommending an alcoholic tincture of the bruised seed, not the leaves, of the hemlock as the best mode of administering that powerful and dangerous medicine. As however DeCandolle's theory so generally accords with experience, I should doubt whether the tincture of Hemlock Seed is possessed of the same narcotic properties as the decoction of the leaves. But should experince prove that the seed are narcotic and that this property is communicated to the tincture, then that preparation, for internal use,ought at once to supersede every other form of administration,not only as affording a preparation not liable to the rapid deterioration of watery preparations, but as holding out the prospect of being so much more uniform in its strength and certain in its action, than those derived from the leaves. These it is well known are frequently inert; nay more, are liable to lose their properties through unskilful drying and much more from bad management in the preparation of the extract. It seems scarcely necessary to dwell longer on the properties of this family, which can never be expected to become of importance in this country from the unfitness of the climate for their culture, though these observations might easily be extended to any length. Dr. Lindley, in his Flora Medica, gives a catalogue of no fewer than 126 species more or less suitable for medicinal purposes; and even that list, copious as it is, might be greatly extended. Before however concluding, I may remark, that the common garden cellery when wild and growing in wet ditches and meadows, its usual station, is an acrid poisonous plant, but changed by culture, becomes a favourite sallad. It seems probable that many others might be similarly changed. The seed of the carrot, which is warm and carmnative, is supposed to act principally on the urinary organs.

Remarks on Genera and Species.' Large and very natural orders such as this, are always difficult to divide and arrange in such a manner as to render them easily available in practice towards of discovering the name of a species, and the present is so peculiarly natural, that some Botanists have even gone so far as to assume that it may almost be looked upon as one vast genus and that only very artificial genera can be obtained by its subdivision. To this idea, even in the abstract, I confess I cannot subscribe, for I cannot but think the association of such plants as *Hydrocotyle* and *Sanicula* in the same genus with *Angelica* and *Pastinaca* would be most unnatural. But while I object to such sweeping combinations as these, I cannot avoid thinking, that the number of genera established in this order is already excessive, that is, so far as I can make out from studying their characters. In support of this opinion the genera *Pastinaca* and *Heracleum* may I think be safely quoted, *Pimpinella* and *Ptychotis*, it appears to me, may with equal safety be referred to as another example of the same kind, and doubtless many others might be found. This multiplication of genera can scarcely be matter of surprise in an order like this, where the general similarity among the species is so marked that nothing short of the most careful study enables one to distinguish them and where, in consequence, characters most minute and difficult to make out, and these not always constant, are apt to have higher values assigned than they merit. To this cause I am disposed to attribute the high value attached to the *vittae*, which, so far as my own limited observation enables me to judge, they do not merit, not only as being inconstant, but as being in many instances, from their minuteness, of very difficult application in practice and only to be detected in perfectly ripe seed.

These little resinous deposits occupy a prominent place in DeCandolle's characters both of tribes and genera. Tausch, who strongly objects to DeCandolle's general arrangement, especially his suborders, and proposes a new one for the acceptance of Botanists, excludes them from his sectional or Tribal characters, but adopts them in his generic ones. He derives the characters of his tribes from the external forms of the seed, altogether rejecting DeCandolle's suborders requiring dissection for their determination,and as being inconstant and not always applicable to the species referred to them. That his distribution is really an improvement on the arrangement he wishes to set aside, I am unable to say, my collection being too small to admit of my entering into a comparison, but I suspect both will be found defective when the order is better understood. One point in both, which I consider objectionable, is the great number of sections and subsections—3 suborders and seventeen tribes in DeCandolle's and—12 tribes and 19 subtribes in Tausch's arrangement. The distinctions between these, are often so exceedingly slight as to be quite inapprehensible by all who have not especially devoted themselves to the study of the family and are in short unfit to form good generic characters. The circular method of investigation,which is now rendering such important services to zoology, has not yet been sufficiently extended to botany, though much wanted, for the elucidation of such extensive and natural families as the present. This is much to be regretted, as it is in such instances only, we are enabled to form a just estimate of the value of that system. This therefore seems an excellent example by which to test its powers, as all previous attempts to produce a satisfactory arrangement of the species of *Umbelliferae*, whether artificial or natural have fallen short of the mark—simply it appears to me, from the authors having neglected in the first instance, to determine the intrinsic value of the characters they employed in the formation of their sectional subdivisions, and in the construction of their genera. As this knowledge is indespensible to success in all systems, but forms the primary point of enquiry in the circular one, it promises to succeed where others less attentive to this point have failed.

Linnæus's arrangement according the involucra for example, which has been objected to by even his most determined followers, as being a departure from his own principles of deriving all generic characters from the flower and fruit, seems notwithstanding, to bring together as natural assemblages of genera as the more highly wrought one of Koch and DeCandolle, simply because a uniform value is assigned to the sectional characters ; and I should not be surprised yet to find some one returning to this despised organ for the primary characters of a new distribution. I confess I cannot suppose such an attempt will succeed in producing a natural arrangement, though I think very useful secondary characters may be obtained from the involucra. The proposal of Tausch, that of taking sectional characters from the external forms of the fruit, I think good, but so far as I am able to judge from his characters,is carried too far. Mr. Burnet gives a sketch on a similar plan,which is probably better,his characters being more easily apprehended. That they are the best that could be obtained is a point I am unable to determine, but as wire drawn distinctions are avoided, it promises well. Upon the whole, I am of opinion that the order still stands in need of an able monographist duly impressed with the conviction that most, if not all his predecessors, forgetting that the limits of sections and genera should be marked by broad lines easily seen, have erred in seeking to subdivide on the strength of minute and even theoretical characters when the adoption of other more obvious ones were open to them. Unfortunately for the science this is an error too easily fallen into, one, to which nearly all are liable, and to the extension of which, nothing is tending so much as the now nearly constant practice of giving very extended generic characters, or rather generic descriptions, including a number of useless particulars common perhaps to every species of the order, but which, when accidentally wanting, has sometimes the effect of causing varieties of the same species to be distributed as new species in different genera, and even raised to the rank of distinct genera. That errors similar in kind have always been avoided in this order I am far from thinking, and to me it seems probable, if revised in the way I have suggested,a considerable reduction in the number of both genera and species will be affected with advantage to the whole. There are now known about 1200 species, for the reception of which no fewer than 200 genera have been constructed, surely a most unnecessary multiplication in an order so much alike throughout. As however the subject is one on which I can only reason hypothetically, my acquaintance with it being limited, I refrain from further remark having already I fear said more than is prudent.

In the accompanying plate (No. 117) I have given dissections of one species of each of DeCandolle's tribes found in this part of India, in which I have endeavoured to represent their respective peculiarities, an attempt in which I fear, owing partly to the minuteness of the objects and theoretical character of the distinctions, and partly to the imperfections of the graphic art among us, I have not succeeded to the extent I could have wished.

In explanation of these dissections I shall now subjoin his abridged characters of each tribe.

I. Suborder ORTHOSPERMÆ. Albumen flat, or nearly so, within, neither involute nor convolute, next the commissure.

* *Umbels simple or imperfect. Fruit without vittae.*

1. Hydrocotyleae. Fruit compressed laterally; Mericarps convex or acute on the back. *Hydrocotyle polycephala.*

2. Saniculeae. Fruit ovate globose. *Sanicula elata.*

* * *Umbels compound or perfect; vittae in the fruit various, rarely wanting.*

† *Paucijugate, namely, furnished with primary ridges only.*

3. Ammeneae. Fruit laterally compressed or dedymous. *Ptychotis ajowan.*

4. Seselineae. A transverse section of the fruit, round or roundish or with the miricarps somewhat compressed on the back. *Foeniculum vulgare.*

5. Peucedaneae. Fruit compressed from the back of the mericarps, raphe marginal, margin expanded into a single, not double, wing on each side. (in *Angeliceae* there is a double wing on each side). *Heracleum rigens*

† † *Multijugate, namely, furnished with both primary and secondary ridges*

6 Cumineae. Fruit from the sides of the mericarps somewhat compressed all the ridges wingless. (The transverse section in the figure does not very well correspond with this character, perhaps the fault of the draftsman.) *Cuminum Cyminum.*

7. Daucineae. Fruit somewhat compressed or round from the back of the mericarps, with the lateral primary ridges placed on the flat commissure, the secondary ones either expanded into free prickles or the prickles united into a wing. *Daucus Carota.*

(The transverse section of the figure does not agree well with the character, I believe from having had bad subjects to represent).

II. Suborder CAMPYLOSPERMAE. Albumen marked with a longitudinal furrow, owing to the involute margins.

† *Multijugate.*

Caucalineæ. fruit laterally contracted or roundish, the lateral primary ridges placed on the plain of the commissure, all the secondary ones expanded into prickles or bristles.

† † *Paucijugate.*

8. Scandicineae. Fruit laterally compressed or contracted, elongated, often beaked. *Ozadia faeniculacea.*

III. Suborder CÆLOSPERMAE. Albumen next the commissure, concave or curved longitudinally, that is from the base to the apex.

(A very useless division, as the few genera belonging to it might have been with equal convenience referred to the first.)

9. Coriandreae. Fruit laterally contracted and didymous or subglobose, primary and secondary ridges wingless, often scarcely distinct. *Coriandrum sativum.*

Caucalineae is omitted in the plate, partly for want of room, partly because I do not think it a native of this part of India.

That Tausch's classification might not be altogether unknown among us I shall now give the characters of his tribes, indicating under each the name of the subtribes and Indian genera that belong to it.

He objects to DeCandolle's suborders, constructed on the form of the albumen, because the term *Campylosperme* does not apply to all the plants that he DC. places here, as one genus combines in itself both *Campylospermous* and *Caelospermous* plants, and *Bupleurum rotundifolium* and *B. protractum* are *Campylospermous*, while all the other species are *Orthospermous*, &c. Many other instances of a similar sort are brought forward to show that divisions grounded on such minute differences of structure are artificial and fallacious, an opinion in which it seems next to impossible not to coincide, even though we may feel unable to propose better. That Tausch's is better as a whole, I am unable to say, but as it is grounded on characters which can often be made out long before the albumen has attained the degree of maturity required by the other system, it seems more applicable to practice, that of itself making it a more advantageous arrangement in so difficult an order as this, it too often happening that we are obliged to work with specimens gathered long before their seed are ripe. He further discards all tribal characters taken from the inflorescence, whether the umbels are complete or incomplete, simple or compound ; many of the tribes as constituted by him combining these different modifications. This is to be expected if the seminal arrangement be strictly adhered to, and indeed it seems a most illogical course to pursue, to take our primary divisions from the albumen, that is from the internal structure of the seed, and our secondary ones from the inflorescence.

Tauch's method of taking his tribal characters uniformly from the seed, discarding all collateral ones as only applicable to genera, is a decided improvement on that of Koch and DeCandolle, in whose conspectus we find the first character —" *Albumen intus planum*" —and the second " *Umbellis simplicibus out imperfectis*" the one having not the most remote relation to the other, a circumstance calculated to lower its value in practice, and which, is reduced to nothing, if but half of the objections urged by Tausch against the primary divisions be found true. Leaving these questions for future discussion, I now subjoin in his own words, as given in the Annals des Sciences Naturelles, Tausch's characters of his 12 tribes, and the names of his subtribes with the Indian genera belonging to each, which may be of use in assisting us to form an opinion on the merits of the two systems.

Tribus I. " Ceramospermæ s Testaceæ. Fructus globosus aut globoso-didymus, jugis filiformibus primariis aut simul secundariis, mericarpiis utriculos incompletos commissura plus minusve fenestratos, seu pericarpium bivalve biloculare constituentibus.

Subtribus I. *Coriandreae* Coriandrum.

Tribus II. Rhynchospermae s Rostratae. Fructus pyramidatus aut cylindraceus elongatusve, a latere contractus, apice rostratus, aut plus minusve attenuatus stylisve rigidis rostratus, mericarpiis utriculatis nudis, aut nonnunquam setulosis, jugatis, jugis primariis aut simul secundariis costatis.

Subtribus II. *Scandicineae.* Ozodia W. and A.—Subtribus 3. *Cumineae.* Cuminum. Linn.

Tribus III. Acanthospermae s Armatae. Fructus teres aut compressus, mericarpii utriculatis jugatis, jugis omnibus in aculeos setasve liberas aut basi cohaerentes excurrentibus.

Subtribus IV. *Caucalideae* Daucus, Torilis.—Subtribus 5. *Trachymarathreae.*

Tribus IV. Pterygospermae s Alateae. Fructus teres aut compressus mericarpiis utriculatis, jugis omnibus aut nonnullis in alas membranaceas liberas integras, aut raro bobatas excurrentibus, aut expansis et fructum 4-8 alatum formantibus.

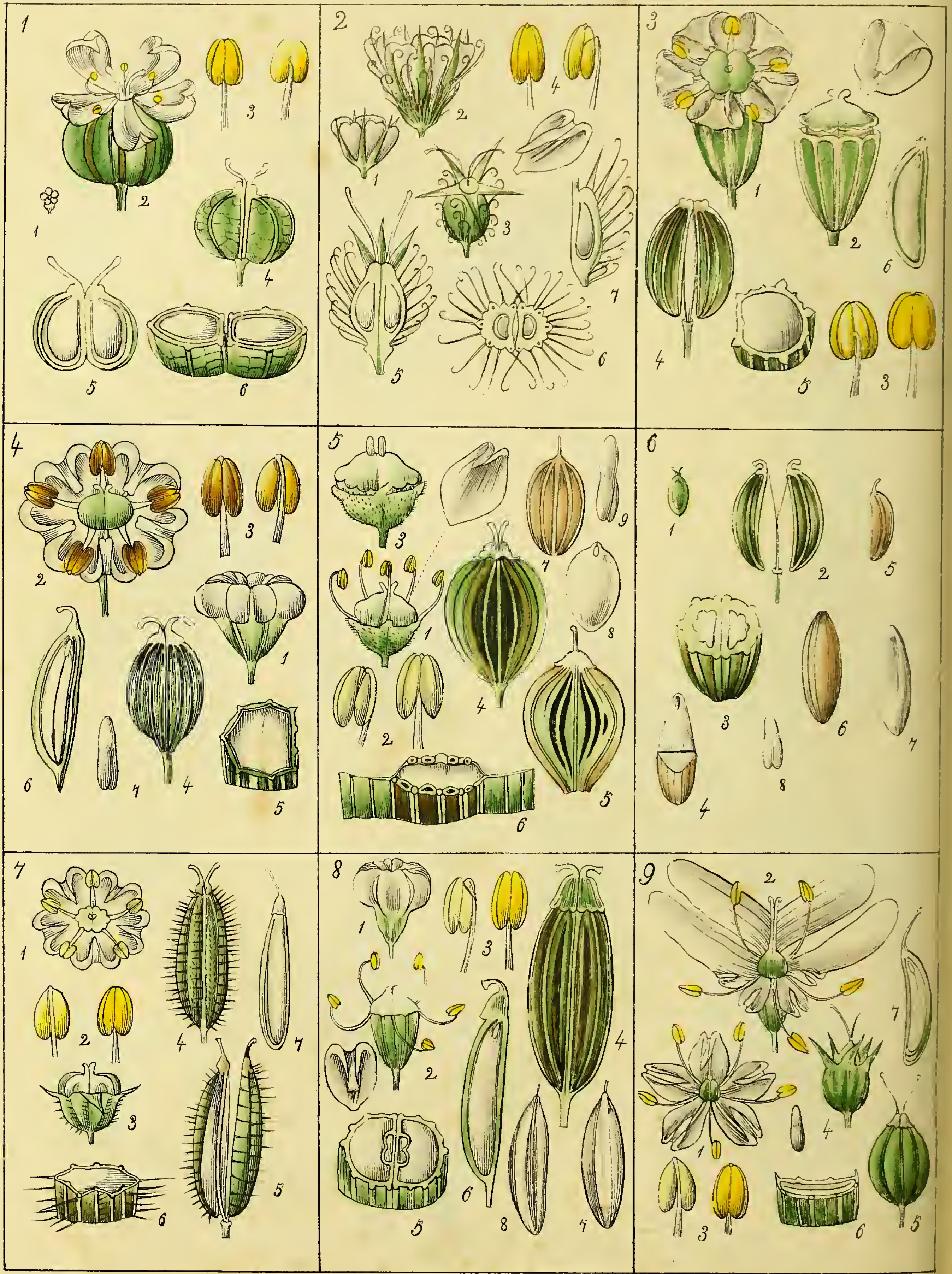
Subtribus VI. *Mulineae.*—Subtribus 7. *Angeliceae.*—Subtribus 8. *Laserpitieae.*

Tribus V. Diclidospermae s Valvatae. Fructus a dorso lenticulari-vel planocompressus, commissura non angustatus, mericarpiis utriculatis, jugis 5 primariis, rarissime et secundariis, raro omnibus costatis, sæpissime 3 dorsalibus costatis, 2 lateralibus in alas aut margines incrassatas sed raphe marginali junctas dilatatis, et fructum utrinque unialatum formantibus.

Subtribus IX. *Peucedaneae.* Anethum, Pastinaca, Heracleum.—Subtribus 10. *Selerineae.*

Tribus VI. Tetragonospermæ s Tetraedræ. Fructus a dorso compressus, saæpe compressissimus, commissura plus minusve sæpe valde contractus, et tunc acute tetragono-prismaticus (non alatus) mericarpiis utriculatis compressis 5—jugatis, jugis filiformibus, nonnullis quandoque obliteratis, intermediis 2 sæpissimc marginem mericarpii utrinque cingentibus et ideo angulos tetraedri marginantibus.

PASTINACA LIGUSTICIFOLIA (W&A.)



Subtribus II. *Azorelleae.*

Tribus VII. Disaspidospermæ s Biscutatæ. Fructus a latere lenticulari compressus, mericarpiis utriculatis jugatis, jugis primariis aut simul secundariis costatis, filiformibus.

Subtribus XII. *Hydrocotyleae.* Hydrocotyle.—Subtribus 13. *Xanthosieae.*

Tribus VIII. Pleurospermæ s Costatæ. Fructus teretiusculus aut latere contractus subdidymus, mericarpiis utriculatis quinquejugatis, jugis costatis sæpe filiformibus, nonnunqua margutis subalatisve aut raro obtusissimis subobliteratis.

Subtribus XIV. *Ammineae.* Bupleurum, Ptychotis, Pimpinella, Helosciadium.
Subtribus XV. *Seselineae.* Fæniculum, Seseli.

Tribus IX. Apleurospermæ s Ecostatæ. Fructus prismaticus aut teretiusculus, mericarpiis utrinque ejugatis sæpissime squamis, vesiculis aculeisve tectis.

Subtribus XVI. *Eryngieae.* Sanicula.

Tribus X. Heterospermæ. Fructus constans mericarpiis duobus utriculatis jugatis, figura et proportione inæqualibus.

Subtribus XVII. *Heterospermeae.*

Subordo II. Monocarpeæ. Fructus constans utriculo constanter solitario monospermo nado, aut sæpissime abortu monospermo et involucro pseudopericarpium uniloculare mentiente incluso.

Tribus II. Monospermæ. Fructus constans utriculo solitario monospermo, non incluso.

Subtribus XVIII. *Actinoteae.*

Tribus XII. Angiospermæ. Fructus sæpissime abortu monospermus, involucro pseudopericarpium uniloculare mentiente inclusus.

Subtribus XIX. *Eohinophoreae.*

EXPLANATION OF PLATE 116.

Pastinaca ligusticifolia
1. Flowering branch, *natural size.*
2. A flower, front view.
3. The same, petals and stamens removed showing the calyx and ovary.
4. Stamens, back and front views.
5. Ripe mericarps ready to fall.
6-7. Detached mericarps, back and front views.
8. A mericarp cut transversely, showing the position of the ridges.
9. Cut longitudinally showing the minute embryo at the apex of the seed.

EXPLANATION OF PLATE 117.

Exhibiting analysis of tribes of *Umbelliferæ*, found in Southern India—See, DeCandolle's Conspectus above.

I. Hydrocotyleæ—*Hydrocotyle polycephala.*
1. Flower, *natural size.*—2. The same, *magnified.*—3. Stamens.—4. Mericarps.—5. The same cut vertically.—6. Cut transversely.

II. Saniculeæ—*Sanicula elata.*
1. A corolla and limb of the calyx detached from the echinate calyx tube, *magnified.*—2. The entire flower, the corolla nearly concealed by the prickles of the calyx tube.—3. Ovary after the fall of the corolla, and a detached petal.—4. Stamens.—5. Fruit cut vertically.—6. Cut transversely.—7. A mericarp cut longitudinally, showing the pendulous seed.

III. Ammineæ—*Ptychotis ajowan.*
1. A flower, *magnified.*—2. The same, the petals and stamens removed and a detached petal.—3. Stamens.—4. Ripe mericarps.—5. A mericarp cut transversely.—6. Cut longitudinally, showing the minute embryo in the apex of the large albumen.

IV. Seselineæ—*Fæniculum vulgari.*
1. Side view of the flower.—2. Front view.—3. Stamens —4. Mericarps.—5. The same cut transversely.—6. A mericarp cut longitudinally.—7. Embryo detached.

V. Peucidaneæ—*Heracleum rigens.*
1. A flower the petals removed, one of them shown detached.—2. Stamens.—3. Ovary.—4. A nearly mature fruit.—5. A mericarp, inside view.—6. The same cut transversely, showing the ridges and vittæ.—7. Seed detached from the pericarp.—8. The same cut longitudinally, showing the embryo.—9. Embryo detached.

VI. Cumineæ—*Cuminum cyminum.*
1. A fruit, *natural size.*—2. Mature mericarps separated, and showing the forked carpophore.—3 Fruit cut transversely.—4. A mericarp dissected to show the embryo.—5. Detached mericarp.—6. Seed removed from the pericarp.—7. The same divided longitudinally.—8. Detached embryo.

VII. Daucineæ—*Daucus carota*.
1. Flower, front view.—2. Stamens.—3. Ovary after the fall of the petals.—4. Mature fruit.—5. Mericarps separating.—6. Cut transversely.—7. The proper seed detached from the pericarp.

VIII. Scandicineæ—*Ozodia fœniculacea*.
1. A flower unexpanded.—2. The same, the petals removed, showing the stamens, *in situ* and a petal from within.—3. Anthers.—4. A mature fruit.—5. The same cut transversely, showing the longitudinal furrow of the albumen.—6. A seed cut longitudinally, showing the minute embryo.—7. Seed removed from the pericarp.

IX Coriandreæ—*Coriandrum sativum*.
1. A flower of the disc, petals all equal.—2. A flower of the ray, the exterior petals larger and heteromorphous.—3. Anthers.—4. Ovary and large limb of the calyx.—5. Fruit.—6. Cut transversely.—7. Cut longitudinally, showing the bow-like curve of the albumen.

LXXIX.—ARALIACEÆ.

An inconsiderable order of plants, but widely distributed over the eastern portions of Asia and the tropical and warmer portions of North America, possessing many of the characters of *Umbelliferae* but differing in habit, most of them being trees and shrubs usually procumbent or climbing. The best known of the family is perhaps the common Ivy. All those that I have met with in this country, except the Chinese Gensing, have a diffuse somewhat climbing habit, like the Ivy, but on a much larger scale, the branches being sometimes as thick as a man's leg.

" Calyx entire or toothed. Petals 5-16, alternate with the teeth of the calyx, very rarely wanting and then (*in Adoxa*) perhaps changed into supplementary stamens : æstivation valvate. Stamens as many as the petals, rarely twice as many, inserted below the margin of a large epigynous disc, anthers 2 celled. Ovarium cohering with the tube of the calyx, of two or more cells, or very rarely of one cell : ovules solitary, pendulous : styles as many as the cells of the ovary, distinct, concrete, or rarely wanting : stigmas simple. Fruit usually fleshy, 2-15-celled, or very rarely with only 1-cell, crowned with the limb of the calyx : endocarp crustaceous. Seeds solitary pendulous. Embryo small, surrounded with a copious fleshy albumen, close to the hilum : radicle pointing to the hilum, superior.—Trees, shrubs, or herbaceous plants. Leaves alternate, exstipulate. Flowers umbelled or capitate."

Affinities. *Umbelliferae* is considered the nearest relation of this order, from which this is principally distinguished by its arborious habit and many celled ovary ; the last, apart from habit, is not always sufficient to distinguish it, the carpels being in one or two genera, reduced to two. The fruit however supplies a good mark being usually pulpy or fleshy *in Araliaceae*, and dry in *Umbelliferae*. By this structure, as well as by habit, it closely approaches *Ampelideae* from which it is only distinguished by the superior ovary and by its stamens being alternate with, not opposite to, the petals. Through *Hedera* (Ivy) it approaches *Caprifoliaceae* (the Elder and Honey suckle tribe) from which however it is at once distinguished by the insertion of the stamens, which in *Araliaceae* is on the disc, in *Caprifoliaceae* on the corolla. Upon the whole I am disposed to consider this order more nearly allied to *Ampelideae* than to any other.

Geographical Distribution. Though the number of species appertaining to this order be small (about 130) they have yet a very wide geographical range, two genera (*Adoxa* and *Hedera*) being found indigenous in England, some in North America, several in the tropical parts of that continent, some in Madagascar and the Mauritias, and a considerable number in Asia and her Islands, where they extend from Cape Comorin northwards to high on the Himalayas, and from Malabar eastwards to China. I possess specimens of several apparently new species, collected in Assam, but which I forbear to name, as Dr. Wallich's list already gives the names of 42 species, among which it is probable they are to be found.

This immense diffusion of some orders, in comparison with others of much greater extent as regards the number of species, is a fit subject to occupy the attention of the Philosophical Naturalist, but has not yet attracted that degree of attention which its interest seems naturally to demand.

Properties and Uses. These are of very minor importance, so far at least as we are enabled to judge from sensible properties. The Gensing *(Panax quinquifolium)*, the root of which is an agreeable bitter-sweet with some aromatic pungency, has a prodigious reputation

among the Chinese as a stimulent and restorative " but by Europeans and Americans is considered nothing more than a demulcent, approaching liquorice in its qualities" Lindley.

The same author justly remarks, " this however requires further investigation, for we cannot believe that all the Chinese say, believe, and practice, is fabulous or imaginary." If we look back to the medical history of Sarsaparilla, now so much and deservedly esteemed as a remedial agent, though 30 years ago much contemned, the sensible properties and mode of administration of which greatly resembles Gensing, we will perhaps find an explanation of this difference of opinion. This supposition seems the more probable, as American writers compare *Aralia nudicaulis*, another plant of the order, with Sarsaparilla, and affirm it to be as valuable a medicine. These cases serve to show that we ought not hastily to reject popular medicines merely on the strength of rough chemical analyses, or because their operation is so imperceptible that they produce no very obvious effect on the human constitution until they have been administered continuously for some length of time.

Remarks on Genera and Species. The number of genera assigned to this order by DeCandolle and some other recent writers on botany amount to thirteen. Meisner raises these to 17 after removing *Adoxa*, one of DeCandolle's genera, thereby adding 6 to the number indicated by the former. But to four of these he has appended a mark of doubt thereby intimating that he is uncertain whether they really belong to the order. Of the doubtful ones two are Indian, one beautifully figured by Mr. Griffith in Wallich's *Pl. Asiat Rariores*, the other, described but not named in our Prodromus under the provisional appellation of *Araliacea ? Kleinii*. Of the remaining genera several are not I think tenable, the distinctions being very slight and not supported by marked differences of habit. Between *Hedera* and *Paratropia* I can see no sufficient difference. DeCandolle defines *Hedera* "Styli 5-10 connniventes aut in unicum concreti" and *Paratropia* " omnia Araliae aut Hederae, sed stigmata sessilia, primo approximata et disco epigyno immersa" distinctions by no means readily obvious in practice, at least so I find them, as two specimens, one taken from a reputed *Hedera* the other a *Paratropia*, when laid side by side on the stage of the microscope, I found so like, that I could scarcely tell the one from the other. Further distinctions are taken from the calyx, whether the limb is a little longer or shorter, which are variable marks and not to be depended upon. In *Hedera* the petals are described in our Prodromus as cohering at the point and separating like a calyptra, while in *Paratropia* they are said to expand. This also in the examination of a number of specimens I find equally unstable and valueless. The difference between *Aralia* and these, consists in its styles being free and devaricately spreading, ("styli 5 expansi devaricato-patentis" DC.) surely a very inadequate generic character, though it might serve as a sectional one to aid in dividing a large genus. On this however I do not insist, as I have no genuine *Aralia* to examine.

Gilibertia, of which I have a species only slightly differing from Roxburgh's *G. palmata*, perhaps a mere variety, differs from the preceding genera in the length of its style only. In this it is distinctly prominent and conical, projecting some distance beyond the disc, but in other respects it seems sufficiently to associate. Whether the difference indicated, merits the distinction of elevating those plants in which it occurs to the rank of a genus, I am unable to say, yet, as it has already been so employed and is readily obvious in practice, I offer no objection, merely observing that *G. Nalagu*, the authority for which is Rheede's plate, Hort. Mab. 2-26, certainly does not belong to the order, but is a species of *Leea*. *Sciodophyllum*, the generic character of which, as given by DeCandolle, is " Omnia Araliæ sed petala apicibus in calyptræ formam cohærentia " This reduces it to *Hedera*, as defined by us, but DC. gives *Hedera* free petals, which I find sometimes the case, sometimes not, a specimen now before me of *H. Helex var chrysocarpa* DC., having free petals, while the European plant seems to have them cohering. The character in short is one of almost no value, and ought not to have so high an one assigned. The whole of these genera, as now defined, might I think with great advantage be reduced to one ; as genera grounded on such variable and inappreciable distinctions, can never be good ones, nor in any way tend to the advancement of science. Genera so purely artificial are misplaced in a natural system, where we look for natural ones, and the sooner they are discarded, and with them the doctrine which inculcates the non-existence of natural genera the better, as, it appears to me, nothing tends so much to undermine true science, as the maintenance of such principles. The existence of such a doctrine, confers on even the merist tyro,

who happens to find an accidental variation of plant, not coming within the very narrow lines of demarkation which separate such genera, the right of at once constituting it a new genus. An Ivy by having a narrower more contracted calyx limb becomes *Paratropia,* or by having its styles cohering and somewhat elongated becomes a *Gilibertia,* or if its petals cohere and fall like a calyptra, no unusual case, especially when dried specimens are under examination, it passes into *Sciodaphyllum.* Can any thing be more trifling? can the authors themselves of such generic characters look at them, when thus analysed and contrasted, without smiling?

Panax though very nearly allied, yet having an ovary with only 2 or 3-cells has its limits clearly defined by a comparatively invariable and important point of structure, but *Maralia* does not seem distinct from it. *Gastonia* having twice as many stamens as petals is another good genus. The one-celled ovary of *Anthrophyllum* (Blume) seems to point it out as another.

I urge with greater confidence the reduction of the above named genera as Wallich has already done so in his list, where we find no fewer than 42 species ranged under the genera *Panax* and *Hedera.* Those species, I presume, having a 2 or 3-celled ovary being referred to the former, the remainder, those namely having the ovary 5 or more celled, to the latter. The calyx being a little more or a little less developed, the petals a little earlier or a little later deciduous, the styles a little longer or a little shorter or more or less cohering, merit not the distinction of being taken into account as generic characters: and to multiply genera on such characters is, in my estimation, alike unphilosophical and unworthy of science.

The genus *Miquelia* Meisner, our *Araliacea? Kleinii,* if really a member of this order will probably prove a good genus, but in the mean time, while the male plant only is known, it seems to associate too well with Wallich's *Phytocrene* to be admitted as distinct. Both are dioicous, in both the perianth is 4 partite and valvular in æstivation, the stamens in both are 4, the filaments united at the base with a sterile pistillum (on this point our character in the Prodromus is erroneous), in both the anthers are fixed by their back near the base, dehiscing longitudinally, in both the stem is twining, the leaves alternate, the flowers congregated on the apex of the peduncles, forming a capitulum in the one, and a simple umbel in the other, the base of the pedicels in both are furnished with a cup-shaped 4-cleft hairy bractea or squama, and lastly, the structure of the stem is the same in both; the very curious woody plates so admirably represented by Mr. Griffith in Wallich's *Ph. gigantea* being equally found here.

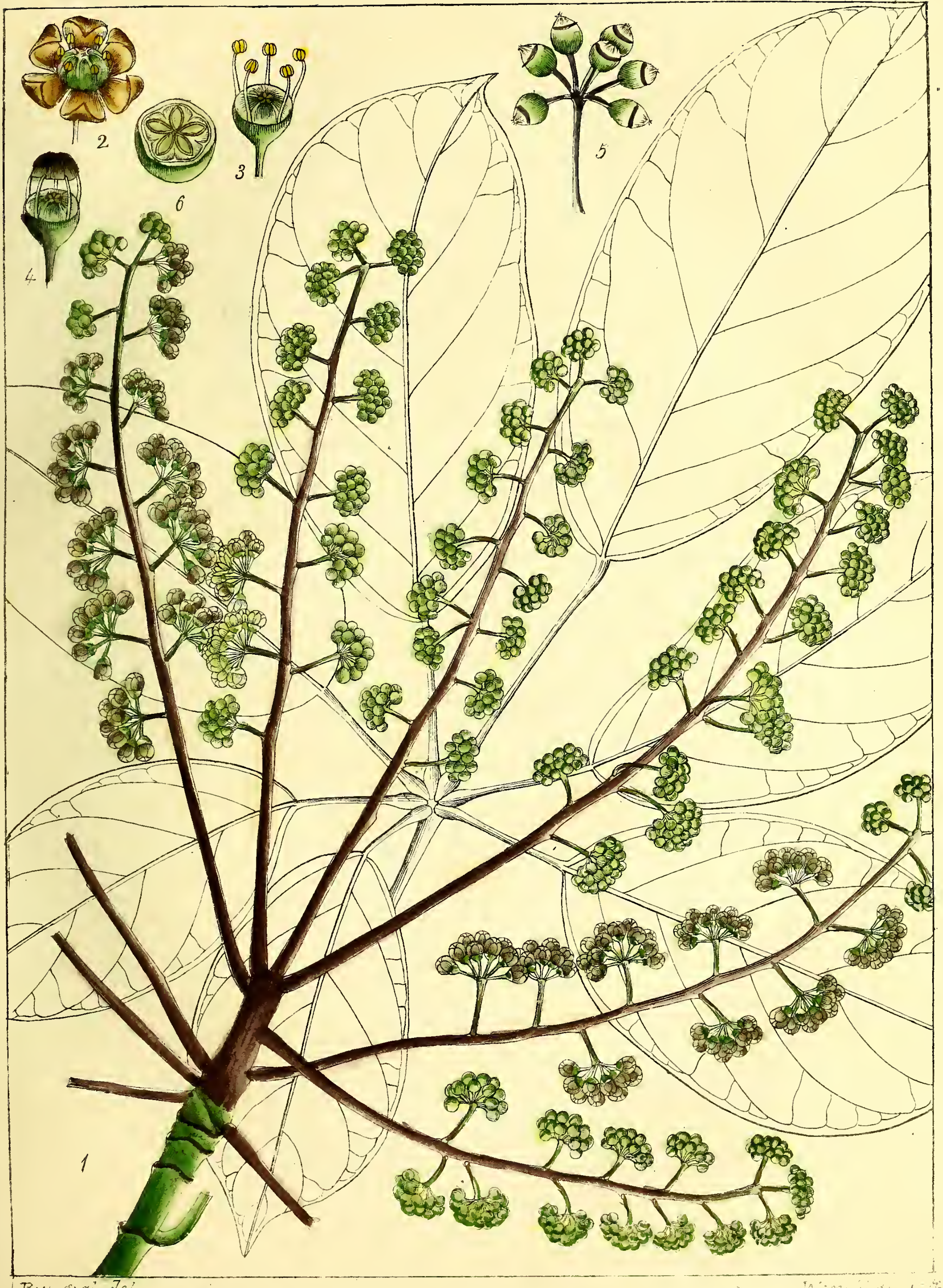
The differences then between the two being, so far as our present information goes, only specific not generic, I propose referring our *Araliacea? Kleinii* to Wallich's genus *Phytocrene* a position which the identity of the lignious structure even more than the similarity of the floral one tends to confirm; that structure being as yet unknown beyond this genus. The order to which the genus belongs, yet remains to be determined. The circumstance of our having referred one species and Meisner another to *Araliaceae* seems strongly in favour of this order finally proving its station, but until the female plant has been discovered this rests on mere conjecture.

EXPLANATION OF PLATE 118.

Paratropia venulosa. W. and A.
1. Flowering branch, *natural size.*
2. A flower opened to show the relative position of the petals and stamens.
3. A flower, the petals separated showing the stamens, ovary and stigmas.
4. A flower, the petals separated at the base, but still hanging on the apex of the stamens.
5. An umbel of fruit.
6. A berry cut transversely, 5-celled, with one seed in each.

CLASS 4TH—EPICOROLLAE CORISANTHERAE.—*Juss.*

Torus between the tube of the calyx and the ovary, and usually forming at its extremity a small disk (epigynous) on the summit of the ovary, which finally coheres entirely, or rarely only at its upper margin, with the calyx tube. Petals usually united into a gamopetalous corolla, or rarely free, inserted on the outside of the disk. Stamens inserted on the corolla. Anthers distinct.



PARATROPIA VENULOSA (W. & A.)

LXXX.—LORANTHACEÆ.

A curious and widely distributed order of parasitical plants, abounding in species but with very few genera, seven only being enumerated by Meisner, the latest writer to whom I can refer, for upwards of 400 species. DeCandolle refers about 330 species defined by him to 3 genera, but some of these are certainly imperfectly known and others may be repetitions, which the author had no opportunity of detecting by comparison of specimens: but to set against these many have since been discovered, which will probably suffice to maintain the numbers nearly as here stated. In their habits the order is most remarkable, being with a very few exceptions parasitic, growing upon, insinuating their roots into the substance, and drawing their nourishment from the juices of living plants, a property, known to be possessed by very few cotyledonous plants in the whole circle of the vegetable kingdom. To fit them for this mode of propagation, their seed are covered with a viscid glutinous substance, which adheres tenaceously to whatever it comes in contact with, and retains it there, until circumstances favourable for exciting vegetation occur, when it pushes forth its radicle, the extremity of which it curves towards its support, on reaching which it becomes enlarged and flattened having the appearance of a sucker. From this enlargement the fibrous roots emanate, spreading themselves on all sides between the wood and the bark. In course of time, as the branch thickens by subsequent depositions of wood, these roots become gradually embedded in its substance, not by their power of penetrating it, but simply by new deposits over them. Though the space I have to devote to the subject is now greatly reduced, I cannot deny myself the pleasure of enhancing the value of my work by introducing a rather long extract " on the mode of Paritism," from a very able paper by Mr. Wm. Griffith, lately published in the Linnean transactions " on the ovula of *Loranthus* and *Viscum*."

" The only species in which this has been studied in any detail is the *Viscum album*, and even here the statements are not altogether satisfactory. The latest account which I have seen is that of DeCandolle in his excellent *Physiologii Vegetale*, vol. ii. p. 790, and more fully in vol. iii. p. 1409, where the subject is treated in the usually luminous manner, so characteristic of this distinguished author.

" The mature seeds of all the species of *Loranthus* adhere strongly to the substance on which they are applied by means of the viscous matter. This viscum soon hardens, and then has the appearance of a transparent glue. The first changes take place in *L. scurrula* two or three days after application, and consist of a curvature of the extremity of the radicle towards the support; this extremity when it reaches this point becoming enlarged and flattened.

" It has now the appearance of a sucker, such as those, for instance, of the *Cassytha filiformis*. I am unable to state the precise manner in which the radicle penetrates the bark. The operation seems to require some time, and it is not until it is completed that the plumula begins to be developed. In those species the cotyledons of which are soldered together, the plumula passes out by one of the clefts; in the others by the fissure between these two bodies. The cotyledons in all the species I have examined remain inclosed in the albumen, which substance begins to disappear as soon as the plumula commences to be developed; the cotyledons undergoing a corresponding diminution in size. By the time that the young plant is furnished with a pair or two of leaves the attachment will be found considerably firm. If we cut away the portions of the support, and lay bare the included portion of the parasite, we find that the application takes place entirely between the lignious systems of both, the fibres of the sucker-like root of the parasite expanding on the wood of the support in the form of a *pâte d'oie*. There is, however, no interchange of structure between them; neither at this period is there any intermixture of lignious fibres. As soon as the young parasite has acquired the height of two or three inches, when an additional supply of nourishment is probably required, a lateral shoot is sent out, which is, especially towards the apex, of a green colour. This at one or two, and subsequently at various places, adheres to the support by means of sucker-like productions, which are precisely similar in structure and in mode of attachment to the original seminal one.

" As the parasite increases in size, these lateral shoots become frequently very numerous, and give origin, I believe, always from those parts immediately opposite to the sucker like adhesion likewise to stems and branches. During the same period the fibres of the suckers be-

come more and more imbedded in the lignious system of the support, owing to the deposition of the new wood of the latter. The fibres of the parasite never penetrate beyond their original attachment, although the later developed fibres appear to have the power of arriving at this point, but no further. This is very remarkable. In the adult plant the sucker bearing shoots frequently run to a considerable distance, many of the stocks being literally covered with parasites, all of which have originated from one seed. I have seen such shoots, which had taken their course along a decayed branch, become reflexed, and return in quest, as I may express it, of a part capable of affording due nourishment. In all the species of *Loranthus* which I have examined the same phenomena occur, and also in the species of *Viscum* from which the drawings were made. I have reason to believe, however, that in some *Loranthi* and *Visca* the attachment takes place by one spot; in other words, that there is only a primary attachment: such will approximate in form to be *Viscum album.*

" The sucker-bearing shoots frequently run contiguous to each other, and are occasionally reciprocally united by " suckers ;" in such there is actual communication between the lignious system."

As already observed nearly all the plants of this order are parasitic, the genus *Nuytsia* is mentioned as the only exception, but Mr. Griffith informs me that he once found a terrestrial *Loranthus.* An occurrence so unusual, almost leads one to suspect that the plant in question can scarcely belong to that genus. All the species of *Loranthus* and *Viscum* are shrubby with jointed branches and succulent leaves. On this account they are very troublesome plants to dry, being apt to break at each joint, and to lose their leaves in the process, and when dried are scarcely worth the trouble, from the difficulty of examining their structure after having undergone that operation.

" Calyx with a smaller calyx, or bracteæ, at the base of its tube: limb short, entire or lobed. Petals 4-8, free or more or less united: æstivation valvular. Stamens as many as the petals, and opposite to them: filaments more or less combined with the petals: anthers versatile, or erect, or adnate. Ovarium cohering with the tube of the calyx, 1-celled: ovule solitary: style filiform or almost wanting: stigma capitate. Fruit fleshy, crowned with the calyx, 1-celled, endocarp membranaceous and tough, or somewhat crustaceous, marked with several longitudinal nerves. Seed solitary. Embryo straight, in the axis of a fleshy albumen: radicle next the hilum, thickened or truncated at its extremity. Shrubs, almost all parasitical. Leaves fleshy, entire, opposite or rarely alternate, sometimes wanting."

Affinities. On this head I feel constrained at once to acknowledge my ignorance, knowing no order with which I can compare this. In so far as the solitary pendulous ovulum affords a mark of relationship, I should consider *Loranthaceae* akin to *Alangieae* which is further established by the viscid pulp, by which in both families the seed is surrounded, and by albumenous seed with a superior radicle. Add to these the alternate exstipulate leaves, common to both, and the analogy ceases, unless some further indications of relationship be found on a comparison of the early stages of the ovula. But even these points seem to me of sufficient importance to have attracted the attention of Botanists who have hitherto sought in vain for its relations. By a similarity of structure in the ovarium and seed, they are related to *Corneae,* from which they are said to be principally distinguished by the stamens being opposite the petals in *Loranthus,* alternate with them in *Cornus.* The relationship to *Alangieae,* just indicated, seems to have been overlooked on account of the one family having polypetalous, the other monopetalous flowers, a distinction assuredly not without value, but of very secondary importance, as compared to the structure of the ovarium and fruit especially in this family, one of whose leading genera, *Viscum,* is polypetalous. The same structure, namely monopetalous flowers, has caused this order to be viewed as nearly related to *Caprifoliaceae,* though their ovary, ovules, and seed are widely distinct. Brown, the ablest Botanist of the present day, and of all living Botanists the most intimately acquainted with the structure and affinities of *Proteaceae,* an order which he has deeply studied, points it out as related to *Loranthaceae,* an affinity mentioned on his authority by most recent writers, but by all, in such terms as to convey the impression that they could not detect it. I am not myself very intimately acquainted with either order and therefore do not attempt to examine the question, but I have the authority of Mr. Griffith, who has studied *Loranthaceae* with very great care, for stating that " every

thing down to the ovule tends to prove the value of Brown's remark, that *Loranthaceae* are akin to *Proteaceae*" a view which I hope at no distant period to see fully made out by him now that he is preparing to publish the results of his own most extensive and valuable labours. In the same letter, that most accomplished Botanist makes another remark of great value and which should never be lost sight of, though not always easy to be acted upon. "Botanists, he remarks, publish too much from dried specimens—a dried *Loranthus* is generally a sealed book." I shall close these remarks with another extract from his Paper on *Loranthus* and *Viscum*, an essay which cannot be too extensively known or too deeply studied, as exhibiting the results obtained in the course of a most patient and philosophical investigation on one of the most obscure questions of botanical science—The formation of the ovule.

"From what has been stated, it will appear that the ovulum is, both in *Loranthus* and *Viscum*, a formation subsequent to impregnation This remarkable and, I believe, unparalled fact, will tend materially to increase the difficulty of understanding or even conjecturing the nature of the first steps in the formation of an embryo. It is evident that it is at total variance with the idea that the ovulum, or female organ, is a nidus adapted to, and necessary for the development of the embryo, which in this view is supposed to be derived entirely and directly from the male. It is needless to add that it is totally different from the usual development of ovula.

"With respect to the first part of the process of development, I may observe that original continuity of tissue is very general, and perhaps universal. And, in particular, I believe the nucleus of an ovulum to be *ab origine* solid: whatever is produced subsequently in its interior being developed in a cavity formed by an excavating process.

"Although there can be no doubt from its structure and functions, that the fleshy body in which the mature embryo is more or less contained is albumen, yet it may be proper to state in what part of the tissue the necessary change is carried on; particularly since there is, I believe, no instance of albumen occurring as a primary formation.

"The albumen in both these genera may, therefore, be classed with those albumina which are developed in the tissue of the amnios and inclosed in an ordinary integument or integuments, with this obvious difference, that in the subjects under consideration this body is naked.

"There is an evident resemblance between the nipple-shaped process of *Viscum*, and the often stipitate, free, central placenta of *Santalaceae*, especially when more than one embyro is developed in the above genus."

Geographical Distribution. Though most abundant in the tropical regions of Asia and America, species of this order extend far beyond these limits, both north and south. The common Mistletoe (*Viscum album*) is well known in Britain, and some others are natives of Europe. The genus *Loranthus* is met with in Europe, America and every part of India, both on the plains and mountains, extending from the Southern extremity of Ceylon, to a considerable elevation on the Himalayas. On the highest tops of the Pulney mountains and also high on the Neilgherries they are met with, but much less abundantly than on the plains and at lower elevations on the hills. The genus *Viscum* also, abounds equally on the sea coast and the hills' though from its species being fewer, it is not so common as *Loranthus*.

Generally speaking they grow on nearly all trees though more common on some than others. The Mangoe in some parts of the country is a favourite resort, so also are some species of Acacia, and I have seen a *Viscum* on a *Loranthus*: DeCandolle excepts lactescent trees, which may perhaps be usually the case, but not always, as I have seen a *Loranthus* on a Ficus and Mr. Griffith found one on the common Jack tree (*Artocarpus integrifolia*) which is lactescent.

India and the Malayan Peninsula are said to produce 90 species. That such may be the case I could not take upon myself to deny, though I feel considerable doubt of the correctness of the statement, owing to the difficulty of determining the species: all of them being so liable to great variations, especially in their foliage, that characters taken from it can rarely be depended upon if not confirmed by others derived from the inflorescence or fruit. Attention to this circumstance led to the reduction of many species in our Prodromus. Others, it is probable, may be discovered to replace some of those reduced, but perhaps there are yet many superfluous ones, which will require to be struck out of the list before it can be said to be free

from redundancies, and much as we have curtailed the list I am not quite sure that all ours are unexceptionable. In an order generally so unmanageable and where dried specimens are so apt to mislead, it is not to be wondered at, if many unteneable ones have been admitted on its list of species which will yet require to be reduced, and until this is done we can only make remote guesses as to the numerical proportion they bear to the flora of the country.

Properties and Uses. Much has been written on the efficacy of the Mistletoe in the cure of Epelipsy, and other spasmodic and nervous diseases, and some apparently very strong cases in its favour have been published, but in spite of these it has fallen, at least among English practitioners, into total disuse, and no doubt were it as satisfactory to publish failures as successful cases, there would be no want of examples of such to be found in the Medical Literature of the time. But as silent neglect seems equally efficaceous in discarding an inert medicine from practice, that is the plan usually pursued in cases of failure. This plant having so completely failed to maintain its character as a medicine, it is unnecessary to say more regarding it here.

In its chemical properties it is somewhat more interesting; the peculiar viscid juice surrounding the seed (whence the name *Viscum*) as well as the green parts of the plant abound in the peculiar, very adhesive matter called Bird-lime, principally composed of a resinous matter which in modern chemistry has received the name of *Viscin*, and it is believed may be obtained from nearly every species of the order by the usual process of boiling the bruised bark for several hours, then burying it in earth covered with stones until it ferments and changes to a mucilaginous consistency, afterwards pounding it in a mortar until it becomes a paste and washing it with river water to remove the impurities.

To those interested in ornithology and to whom it may be desirable to obtain uninjured specimens, it may prove useful to know that plants abounding with this substance are of common occurrence in this country. I know no other use to which they may be applied.

Remarks on Genera and Species. Under this head I have nothing to add to what is already published in our Prodromus. The number of genera has since the publication of the 4th Vol of DeCandolle's Prodromus been augmented from four to seven, but none of the new ones have been found in India. In Southern India two only have yet been detected, but two species of a third which have been referred here by DeCandolle, were found by Dr. Wallich in Nepaul. These, however, in the opinion of Dr. Arnott must be excluded from the order. They differ from most of the others in being terrestrial, not parasitic plants, and in having a one-celled ovary, with three ovules attached a central column: a structure in which they associate with *Symphorema*, which has a similar ovary with 4 ovules pendulous from the apex of a central column. This structure, combined with the stamens opposite the segments of the corolla, induces Meisner to refer it to *Mysineae* and should such ultimately prove to be its true place, then I presume *Symphorema* will also find a more suitable station there, than among the *Verbinaceae* where it is now doubtfully placed, though I do not think either family the most appropriate station.

Various attempts have been made to subdivide *Loranthus* into smaller genera, but according to Meisner—an excellent Botanist—the proposed genera are constructed principally on variations of habit, and with characters scarcely sufficiently permanent to be received as satisfactory, an opinion in which I fully coincide.

So much space has already been devoted to this article that I should have hesitated about extending it by the introduction of remarks on species even had my materials permitted of my doing so, but such is not the case, the only decidedly new species I have added to my collection having already been published in table 306 of my Icones, and also by Sir W. J. Hooker in his *Icones Selectae*. As however Dr. Arnott's specific character which accompanies that plate is fuller than mine, I shall here republish it in his own words.

Loranthus lageniflorus.

Corolla longe tubulosa æqualiter 5-fida, antheris erectis, involucro campanulato magno colorato circa flores paucos subcapitatos.—*Arn.*

Hab.—Malabar.—*Dr. Wight.*

Lignosus, glaber, parasiticus. *Folia* opposita, petiolata, petiolo 2–4 lineas longo, ovato-lanceolata, seu elliptico-oblonga, obtusa, basi rotundata, penninervia, crassa, coriacea. *Pedunculi* fasciculati ad ramos annotinos orti, brevissimi, apice involucrum sanguineum gamophyllum campanulatum magnum 4–5-lobum ferentes. *Flores* 4–5 in fundo involucri subsessiles. *Calycis limbus* cupularis membranaceus, repando-5-dentatus. *Corolla* puberula, tubulosa, involucrum duplo superans, apice supra medium quinquefida, versus laciniarum basin per æstivationem inflatim annulata, laciniis linearibus demum reflexis. *Antheræ* erectæ.—*Arn.*

This is perhaps the most beautiful of the Genus. Its blood-red involucres are about an inch long, and four to six lines across.—*Arn.*

P. S. When preparing the preceding portion of this article, I had not materials at hand for furnishing correct analyses of the flowers of this family. These I have now obtained of two genera, *Viscum* and *Loranthus* ; (see table 122,) those for the former taken from *V. orientale*, for the latter from the *β* variety of *L. loniceroides.* The former, however, I now find departs from the character of the genus in having diandrous flowers (not tetrandrous), and an erect, not pendulous ovule, whence I presume it ought to form the type of a new genus. Here the anterior and posterior sepals only bear anthers, they, however, agree with those of *Viscum* in being cellular. The principal peculiarity of the species of Loranthus, here represented, is the tubular extension of the, so called, calyx, or rim surmounting the ovary, the true nature of which is still undetermined, being equally present, though less developed, in *Viscum*, but in that genus the perianth is called calyx, and the parts sepals, while in *Loranthus* it is called corolla and petals, both of which can scarcely be right. On this subject, Lindley well remarks:

"It is customary to call the floral envelopes of the genera of Loranths by the name of sepals in *Viscum*, and of petals in *Loranthus*, because in the latter genus we find a cup-like expansion, which is regarded as a calyx. It seems, however, impossible to doubt that the parts of the perianth are really of the same nature in both instances, as is proved moreover by the stamens, which are applied to their face in both cases. Schleiden, indeed, calls the male flower of *Viscum* naked, and supposes it to consist of nothing but anthers ; but M. Decaisne has more correctly shown the male flowers of that genus to consist of four anthers, grown to the inner face of four calycine sepals. The rim exterior to the calyx, which has given rise to the idea that the coloured part of a Loranth is corolla, is present in *Viscum* also, in the form of a slight annular swelling ; and is in all probability analogous to the raised line terminating the cup, from which the sepals spring in *Chryseis* or *Eschscholtzia.* In fact we must in theory regard the flower of a Loranth to consist of a fleshy, cup-like expansion of the end of a branch, from the upper edge of which expansion the sepals rise."

These views, in which I quite coincide, mainly on the ground of the position of the stamens opposite the lobes of the perianth, show that this is not a truly dichlamydeous family, and that it is erroneously placed here. If the perianth of *Loranthus* be a corolla with the stamens opposite the lobes, that structure would establish an affinity with *Primulaceæ* and *Myrsiniaceæ*, not borne out by other characters, and which therefore has not been noticed by systematic writers. But viewed as a stameniferous calyx, herbaceous in *Viscum* and petaloid in *Loranthus*, its affinities are altered, and it takes its place among a large group of orders coinciding in that structure.

In addition to the remark above, under geographical distribution, that they are sometimes found growing on lactescent plants, I have since become acquainted with an additional instance in the case of my *L. Euphorbiæ*, which I have always found growing on the very milky stems of *E. tortilis*, but never itself milky, showing its eliminating power: while on the other hand, I have been informed that when growing on the Nux vomica, they become poisonous, acquiring the properties of the fostering tree.

EXPLANATION OF PLATE 119.

Loranthus obtusatus.

1. Flowering branch, *natural size.*
2. A dissected flower, showing the attachment of the 4 stamens.
3. The ovary with its attached bracteole.
4. The ovary cut transversely.—This figure does not, I fear, accurately represent its appearance, which, as here shown, seems to contain numerous ovules but which is, I suspect, a mere visual deception, caused by exudation of juices from the cut surface, not guarded against by the draftsman. The drawing was not made under my inspection and I have not had an opportunity of correcting it, if wrong, by the dissection of new specimens;—neither could I at the time this plate was prepared, procure fresh specimens of a Loranthus with which to supply the illustrations of the order. The figure is in all other respects most characteristic.

EXPLANATION OF SECTIONS C. AND D. OF PLATE 122.

C.

Loranthus loniceroides.

1. Capitulum of flowers, natural size.
2. Corolla split open.
3. Anther, back and front views.
4. Ovary and bracts.
5. Stigma.
6. Young ovary, cut vertically.
7. Ovary more advanced, cut transversely, showing the central ovule and six bundles of vessels in the parietes.
8. A cluster of young fruit.
9. One cut transversely.
10. Cut vertically.
11. Embryo in situ.
12. A detached seed. All more or less magnified. The structure adverted to under No. 4, of plate 119, is a cellular appearance which the newly-cut, full-grown seed exhibits under a considerable magnifying power, but which is not well shown, the cells being much too large in proportion to the rest of the figure.

D.

Viscum orientale.

1. Portion of a flowering branch, showing two cymes of mixed male and female flowers.
2. A female flower and ovary.
3. Male flower seen from without.
4. Same split open, showing the four unequal sepals, two of them antheriferous.
5. Ovary opened, showing the erect ovule enclosed in a sac.
6. Cut transversely.
7. A nearly mature seed cut vertically, showing the embryo lateral, enclosed in a copious albumen.
8. A detached seed surrounded by its viscum.
9. The same freed from the viscum.

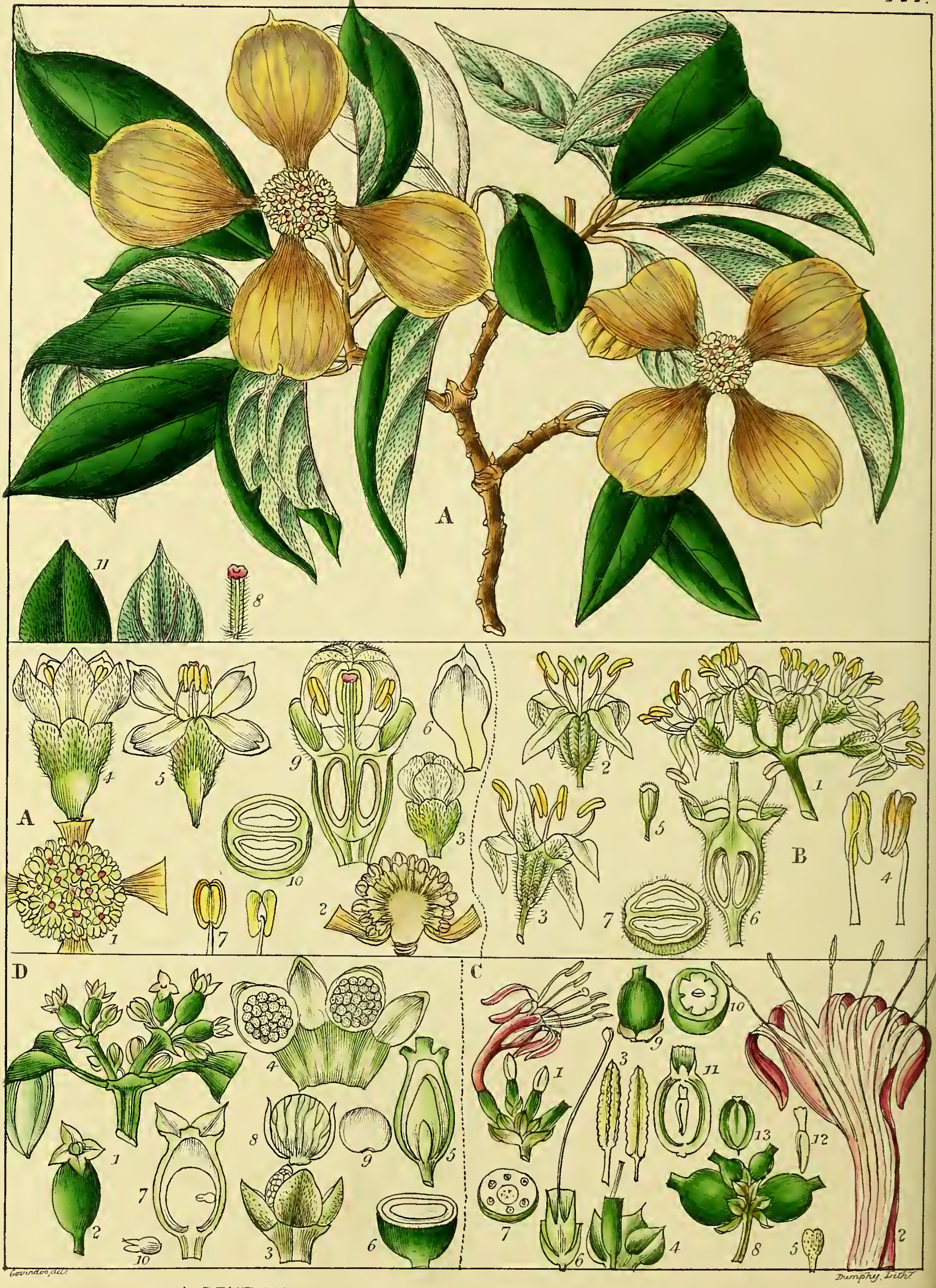
LXXXI.—CORNACEÆ.

This small extra-tropical order, being unknown in Southern India, I originally intended to have excluded it from this work. As, however, there are several species, natives of the Northern provinces extending all along the Himalayan range, from Simla to Silhet, it appears desirable to introduce it, which I now do, though a little out of place, its proper station, following DeCandolle, being between *Araliaceæ* and *Loranthaceæ.* Formerly this order was confounded with *Caprifoliaceæ.* In 1824, Kunth (Nov. gen. et sp. plantar. 3, 75.) separated it as a section from that family, and in 1830 DeCandolle elevated it to the rank of an order in which he has been followed by all subsequent writers. Lindley thus characterizes the order:

"Trees or shrubs, seldom herbs. Leaves (except in one species) opposite, entire, or toothed with pinnate veins. Stipules 0. Flowers capitate, umbellate or corymbose, naked or with an involure, occasionally by abortion unisexual. Stipules 4, superior. Petals 4, oblong, broad at the base, inserted into the top of the calyx, regular, valvate in æstivation. Stamens 4, inserted along with the petals and alternate with them; anthers ovate, oblong, 2-celled. Ovary adherent, two or perhaps 3-celled, crowned with a disk; ovules solitary, pendulous, anatropal: style filiform: stigma simple. Drupe berried, crowned by the remains of the calyx, with a 2-celled nucleus. Seed pendulous, solitary. Embryo in the axis of fleshy albumen, and as long; radicle superior, shorter than the two oblong cotyledons.

Affinities.—These seem somewhat complex, for though a small order, it appears related to many others. Of these Araliaceæ come perhaps the nearest, but are abundantly distinct so far as this order is yet known by their quinary not quaternary flowers, and many-celled ovaries. They are also allied through the Ivys with *Umbelliferæ.* From the section *Sambuceæ* of Caprifoliaceæ, to which in some respects they nearly approach, they are separated by their polypetalous flowers, and the valvate æstivation of their corolla, and being, as in the former case,

LORANTHUS OBTUSATUS (WALL.:)



Govindoo, del. Dumphy, Lith.

A. BENTHANIA. B. CONUS. C. LORANTHUS. D. VISCUM.

quaternary not quinary in the number of the parts of the flower. With *Hamamelidaceæ*, another obscure order in regard to its affinities, they coincide in some important points, especially in the number of cells of the ovary, the position of the ovules and the structure of the seed.

They have also been compared with Loranthaceæ, but if the views given above of the affinities of that order be correct, this family can have no relationship with them, or at all events it must be very remote. Lindley indeed remarks, "in many respects Cornals resemble Loranths from which they differ among other things in the stamens being opposite the *sepals*," which I presume is a mere slip of the pen, as he afterwards shows that the parts of the flower in Loranths called petals are actually sepals, in which case the position of the stamens is the same in both families, and, indeed, is their normal position in all cases where the number of sepals and stamens are equal. Upon the whole, so far as the Indian flora is concerned, the true place for this order is between *Araliaceæ* and *Hamamelidaceæ*, wherever these may be placed, while Loranthaceæ should be removed to be placed among the monochlamydeous orders near *Santalaceæ*.

Geographical Distribution. As already stated, the species of this family are almost exclusively extra-tropical, the temperate and frigid zones of Europe, and Asia, and America, being their native countries. Four species have been found on the Himalayas, but as yet none on the more Southern ranges of mountains. A few are natives of Japan.

Properties and Uses. The bark of some of the American species is esteemed a tonic and lauded as affording a febrifuge nearly emulating the more celebrated Peruvian bark in its power of arresting intermittent fever. No such property has yet been discovered in any of the Indian species, which in their native countries are principally held in repute for the excellence of their timber. In Europe the fruit of some of the species of Cornus is eat, and that of *Cornus suiceca*, a rather common plant in the Highlands of Scotland, is said to be a good tonic, increasing the appetite. In Nepaul, Dr. Royle states, the fruit of Cornus is little esteemed, but that that of Benthamea is eaten on the Hills.

EXPLANATION OF SECTIONS A. AND B. OF PLATE 122.

A.

Benthamea fragifera.
Flowering branch, natural size.
1. Capitulum of flowers.
2. Same cut vertically, showing the globose recepticle.
3. An unexpanded flower-bud.
4.–5. Open flowers; and 6. Detached petal.
7. Anthers, back and front views.
8. Style and stigma.
9. Flower cut vertically, showing the relative position of all its parts.
10. Fruit, immature, cut transversely.
11. Upper and under surfaces of the leaves.
All more or less magnified.

B.

Cornus macrophylla.
1. Portion of corymb.
2.–3. Expanded flower, front and back views.
4. Anthers, front and back views.
5. Stigma.
6. Ovary cut vertically.
7. —— cut transversely.
All more or less magnified.

LXXXII.—CAPRIFOLIACEÆ.

This is a small order principally composed of Northern plants, and for the most part great favourites with all who take an interest in the more beautiful productions of the vegetable kingdom. To this family belong the Elder, the Honey-suckle, the Lauristinus, the Guelder-rose, &c. In tropical countries they are of comparatively rare occurrence and are then confined to the more elevated regions partaking the reduced temperature of higher latitudes. Seven species only, have yet been detected in the Indian peninsula, and one of these, an Elder, I consider a doubtful native, the remaining six are all indigenous on the Neilgherries. Only one, so far as I am aware, a Honey-suckle, has yet been introduced into

the gardens of the plains, and that rarely, as an ornamented creeper: though it strikes me some of the *Viburnums*, especially *V. acuminatum*, a beautiful shrub, might with justice claim a place in the shrubbery of the plains. They seem equally deserving of this distinction, not merely as garden ornaments, but on account of the early associations connected with them.

Calyx with its limb 5- (very rarely 4-) lobed. Corolla of one piece, lobed, sometimes irregular; the divisions alternate with those of the calyx: æstivation never valvular *(D. C.)* Stamens equal in number to the lobes of the corolla (or sometimes one of them abortive), alternating with them, and inserted towards its base: filaments subulate: anthers ovate, bilocular. Ovarium cohering with the tube of the calyx, 3-celled (rare 4- or 5-celled): ovules few in each cell, pendulous: style one and exserted, or none: stigmas as many as the cells, either distinct or combined into one capitate stigma. Fruit crowned by the limb of the calyx, fleshy or rarely almost dry, plurilocular or 1-celled (either by the disappearance of the dissepiments or by the abortion of the other cells). Seeds solitary, in pairs, or several (some often abortive) in each cell, pendulous. Embryo straight, in the centre of a fleshy albumen: radicle superior, next the hilum.—Shrubs. Leaves opposite, without stipules (or rarely with 2 small stipules or glands at the base of each petiole). Flowers terminal, corymbose or axillary.

Affinities. Nearly all Botanists seem to agree in placing this order next *Rubiaceæ*, Endlicher even in some degree united them, as he refers both families to his class *Caprifolia.* Lindley in some respects does the same, as he places it between his *Cinchonaceæ* and *Stellaceæ*, two orders which most Botanists unite under the general name of Rubiaceæ. From that order this is distinguished by its exstipulate leaves and usually pendulous ovules, those of Rubiaceæ, when few in each cell, being for the most part erect, ascending or amphitropal. This, however, is not constant, but interpetiolary stipules are so constant in *Rubiaceæ* that any plant, combining a superior monopetalous corolla, opposite leaves, and interpetiolary stipules, is at once referred to that family, whatever may be the structure of the ovary or even its position in relation to the calyx, as Mr. Brown mentions a Rubiaceous plant, which however I suspect he now refers to *Loganeaceæ*, with a free ovary. While on the other hand, if it wanted the stipules, however exactly it might correspond in other respects, it would be looked upon as a doubtful member, or considered more justly referable to *Caprifoliaceæ.* The number of cells of the ovary is too inconstant in both families to afford good distinctions. In *Caprifoliaceæ* they vary from 1 in *Viburnum* to 5 in *Leycestria*, while 2 and 4 equally occur, 3 however is the predominant number. In like manner in *Rubiaceæ* the cells of the ovary vary from two to five or more. In the section *Opercularieæ* only one occurs, which is by Botanists on that account, considered, a doubtful congener. In both families the seed is albumenous with small embryo and foliaceous cotyledons. Hence it would appear that the absence of stipules is the only absolute difference between the two orders. Lindley traces a relationship, which he thinks would hardly have been expected, with *Saxifrageæ*, through *Viburnum* on the one side and *Hydrangea* on the other. In habit and inflorescence these two genera are almost undistinguishable, but the ovary is very different, the former having it 1-celled with a single pendulous ovule, while in the latter it is 2-celled with numerous ovules, and, as remarked by Lindley, the flowers are monopetalous in the former, polypetalous in the latter. As regards the ovary the relationship is remote, but in all other respects the two genera are nearly allied. The one-celled ovary, with a single pendulous ovule of Viburnum, suggests other relationships not hitherto adverted to but which I will not now attempt to trace.

Geographical Distribution. As remarked above this is a peculiarly extra-tropical family. The species are for the most part confined to the northern parts of Europe and America, but a very considerable number are also natives of the Himalayas which might have been anticipated from the fact of six species inhabiting the Neilgherries. They are rare in Northern Africa. One genus is found in South America and another in New Zealand: their species are nearly all confined to these regions.

Properties and Uses. So far as I am aware nothing is known under these heads

Rungiah del

Winchester Lith

LONICERA LESCHENAULTII (WALL.)

regarding the Indian members of the family. The bark of one species of *Lonicera L. corymbosa* is astringent, and used in dying in Chili, but it is doubted whether this is a genuine species of the genus or even of the order. The Honey-suckles have been long held in high esteem for the beauty or fragrance of their flowers, and several species have been used in medicine, but seem now to have fallen into disuse, except in domestic practice. The berries of most are supposed to be aperient. The Elder has long been used in medicine. The flowers are considered one of the best indigenous sudorifics of Europe, while on the other hand the leaves and inner bark are acrid and poisonous, in large doses, producing violent vomiting and purging.

These properties have led to their being employed as a remedy in dropsical cases. The berries have also been employed in similar diseases, and, made into a conserve, are still to be met with in the shops under the name of Elder Robe, which in domestic medicine is prescribed as a sudorific and aperient. Elder-berry wine is consumed in England to a considerable extent; and made into negus and drank warm, just before going to bed, is a popular remedy of some repute in cases of slight colds unaccompanied with feverish symptoms.

The berries of *Viburnum* are slightly astringent, and in some parts of Europe are employed for making gargles and are administered in slight bowel complaints.

Remarks on Genera and Species. While examining the several genera, with reference to this division of the subject, I became aware of what I cannot help thinking a very curious fact, and one which, *a priori*, I could not have anticipated, namely, that European Botanists do not seem to be aware of the structure of the ovary of Virburnum. All refer to the one-seeded fruit but all lead us to suppose the ovary is 3-celled. DeCandolle describes the fruit as a berry one-seeded by abortion, leading of course to the presumption that there is at least a plurality of ovules if not of cells, while the ordinal character assigns 3 cells, hence we may infer that he believed there were 3 cells with one or more ovules in each. Lindley seems to be partially aware of the fact as he says, "ovary with from 1 to 3 or 4 cells," but does not hint in what genus the solitary cell is found, and in his School Botany gives *Viburnum* a 3-seeded fruit. Arnott and Hooker both, with slight modifications, follow DeCandolle, but neither alludes to *Viburnum.* Endlicher on the other hand goes a step beyond them, assigning "ovarium inferum triloculare" as part of the character of the genus. I have examined the ovary of 17 species, 2 European, 3 American and 12 Indian, all of which, without a single exception, had a one-celled ovary with a single, pendulous ovule, and that in several instances long before the opening of the flower. At what period then does the abortion referred to take place? According to my experience never, as there is never more than one ovule.

In *Lonicera* the number of cells is usually three, with several ovules in each, and frequently all except one or two abort. The example given in the plate of a berry with 5 seeds may, therefore, and not without justice, be suspected of error. Such, however, is not the case, for on examining the specimens from which that figure was taken, I find four and five seeds the usual number; but I must at the same time acknowledge that it was an oversight giving an uncommon form as the type of the genus, without, at the same time, correcting the erroneous impression it is calculated to convey by giving other figures of the normal form. This error is corrected in the accompanying plate, No. 121, giving dissected analyses of several of the genera of the order and of three forms of Lonicera.

The *Lonicera* represented may, however, be a new species, differing from *L. Leschenaultii* in the unusual structure of the ovary and fruit and in the persistence of the calyx, in which respect it approaches *Triosteum*, and in that case would retain the name of *L. mollis*, which Wallich has already given, but which, for want of sufficient characters, we reduced to a synonym of the other.

The accompanying plates, Nos. 120 and 121, contain analyses of four genera, all appertaining to the Indian Flora, and therefore suitable subjects for this work.

EXPLANATION OF PLATE 120.

1. *Lonicera Leschenaultii?* or *L. mollis*, flowering branch, natural size.
2. Corolla split open, showing the stamens.
3. Ovary, style and stigma, with accompanying bracts and bractiols.
4. Transverse section of a nearly mature fruit—5-celled and 5-seeded.

The ovary of several flowers I have examined is invariably 4-celled, this therefore must be an accidental augmentation.

EXPLANATION OF PLATE 121.

A.

1. *Viburnum cotinefolium*, flowering branch, natural size.
2. Portion of the cyme showing the bracts, bractiols, flower-buds and an expanded flower.
3. Corolla split open.
4. Anthers, back and front views.
5. Ovary—6. the same cut vertically showing the solitary ovule pendulous from the apex of the cell.
7. A raceme of fruit of V. Wightianum, natural size.
8. A berry cut transversely, showing the foliaceous embryo in the centre of copious albumen.
9. Berry cut vertically showing the radicle pointing to the apex.

All, with exceptions mentioned, more or less magnified.

B.

I. *Lonicera Leschenaultii* or *mollis*.
1. Two flower-buds with bracts and bractiols.
2. Corolla split open.
3. Anthers, back and front views.
4. Style and stigma.
5. Ovary cut vertically.
6. An immature fruit cut transversely.

II. *Lonicera Leschenaultii—true.*
Same parts and numbers as above.

III. *Lonicera ligustrina.*
Numbers and parts of the flowers still the same as above.

C.

Abelia triflora.
1. A flower and flower-bud with their bract.
2. Detached flower, the corolla split open.
3. Anthers, back and front views.
4. Ovary cut vertically.
5. Immature fruit cut transversely.
6. An immature seed, showing the radicle, pointing towards the apex.

D.

Leycesterea formosa.
1. Detached flower unexpanded.
2. Flower full blown.
3. Corolla split open.
4. Stamens, back and front views.
5. Ovary, calyx and bract.
6. Ovary cut transversely, and one cell vertically, to show the numerous ovules.
7. A fruit more advanced.
8. The same cut transeversely.
9. A detached seed.

Copied from Wallich's Plant. As. rar.

LXXXIII.—CINCHONACEÆ. *Lindley.*

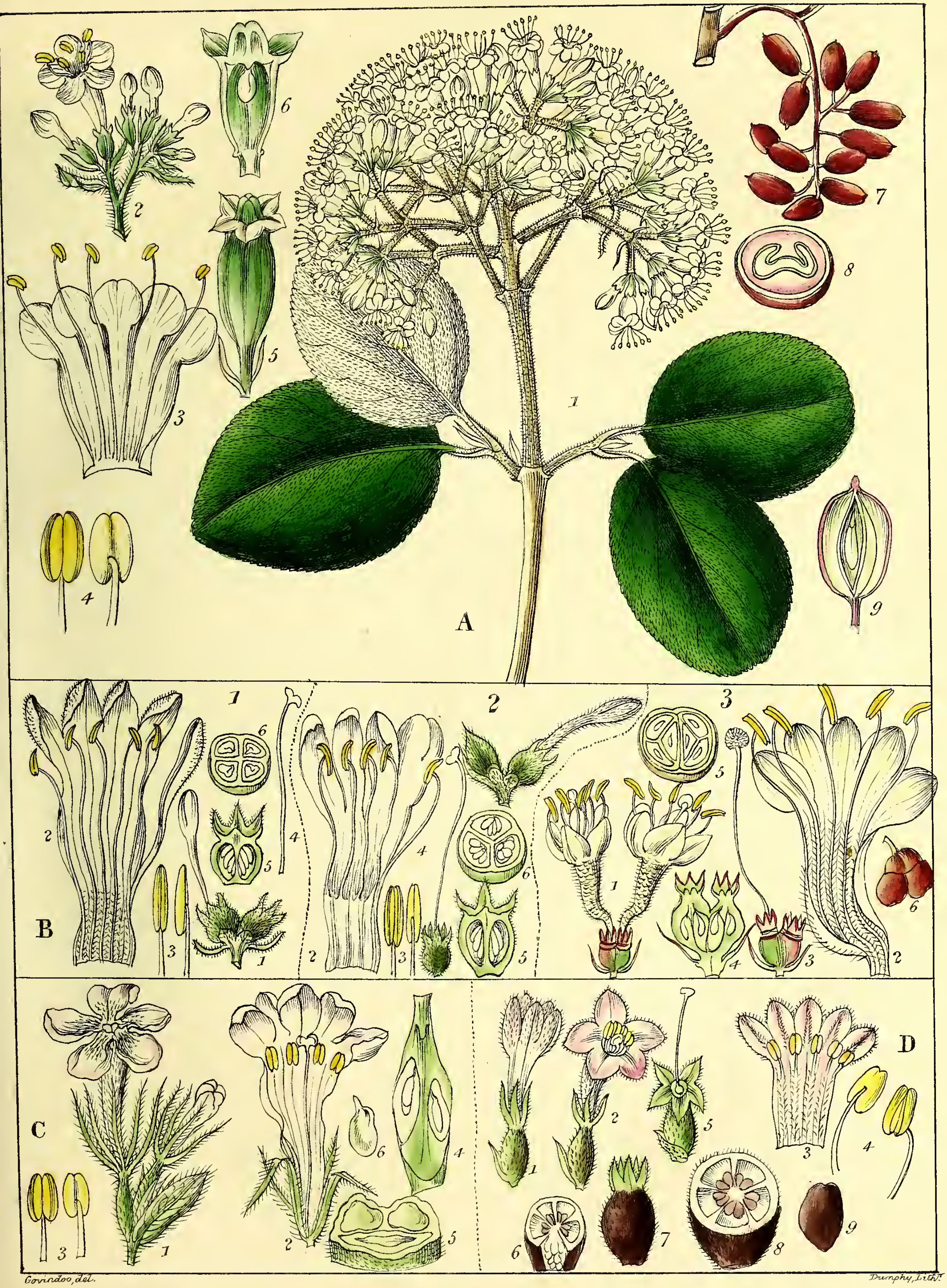
Rubiaceæ Juss., D. C., W. and A., &c.

This is a family of great extent and, viewed in relation to the medicinal and economical relations of many of its members, a highly interesting one, numbering among them the almost inestimable *Cinchona*, or Peruvian Bark, and the scarcely less valuable Ipecacuana. When to these medicines we add coffee, as an aliment, we have a list scarcely equalled in importance by any other family, and yet these form but a small portion of the valuable products contributed by this family for the benefit of mankind. The number of its species is quite in proportion to its utility, though of course vast numbers of them are of no value, or, if they are, their properties are still to be discovered.

In our Prodromus we, in common with all writers on Botany, except Lindley, adopted the name *Rubiaceæ* for this order. As, however, it must be admitted that in the adoption of that name, in the first instance, the celebrated founder of the natural system of Botany widely departed from his own rules in selecting one of the most unimportant and least characteristic genera of the order as the type whence the whole were to derive their family name; and moreover *Rubia* not being a genuine member of the order, I cannot but agree with Lindley in thinking that the sooner we set about correcting the error the better.

Under this view of the case I here adopt his name *Cinchonaceæ*, *Cinchona* being certainly the most important if not the most characteristic genus of the whole 270 combined to form this magnificent family; which may safely be computed to embrace considerably above 2500 species. Among these every form of vegetation is met with, from the lowly annual up to the stateliest trees of the forest.

Character of the Order. Tube of the calyx cohering with the ovarium; the limb various, truncated or lobed, consisting of as many sepals as petals, rarely with accessory intermediate teeth. Petals 4–5, rarely 3–8, united, inserted upon the summit of the tube of the calyx: æstivation twisted or valvate. Stamens as many as the lobes of the corolla, alternate with them (rarely some of them suppressed): filaments more or less combined with the tube: anthers oval, 2-celled, turned inwards: pollen elliptical. Ovarium adherent, usually 2-celled, or with several cells, rarely (by abortion) 1-celled, crowned by a fleshy often urceolate disk: style single, sometimes partly divided: stigmas usually 2, rarely several distinct, or more or



A. VIBURNUM B. LONICERA C. ABELIA D. LEYCESTERIA.

less concrete. Fruit a cremocarpium, or capsular, or baccate, or drupaceous, 2- or many-celled. Seeds one or many in each cell, in the former case attached to the apex, or more usually to the base of the cell; in the latter to a central placenta. Albumen horny or fleshy, copious. Embryo straight or slightly curved, inclosed in the albumen: radicle turned to the hilum: cotyledons foliaceous.—Leaves simple, entire, opposite (very rarely verticillate): stipules 2 at the base of each leaf, entirely distinct, or cohering either with the leaf or with each other, or both ways: their apex sometimes produced into bristles, sometimes into foliaceous expansions resembling verticillate leaves.

Affinities. A very cursory perusal of the above ordinal character will show that, as regards fructification, this is a very complex family. In certain points, however, there is much uniformity. The calyx tube is adherent to the ovarium: the petals cohere, forming a monopetalous corolla with the stamens, more or less perfectly, adhering to the tube and, invariably, equaling them in number, the anthers introrse. So far a nearly uniform structure prevails. The ovary however varies to a great extent both as to structure and contents.

In the tribe *opercularicæ* it is 1-celled with a single, erect ovule. In *Spermacoceæ* it is two-celled with a single ovule in each, but its direction varies, sometimes it is pendulous as in *Knoxia*, sometimes attached near the base of the partition and ascending as in *Bigelowia* (*Borreria*, Meyers) occasionally it is attached by the middle to the middle of the partition and is then said to be peritropal.

In *Hedyotideæ* the ovary is two-celled, usually, with numerous ovules attached to a placenta, but in at least one species they are reduced to two or three, all except one of which abort, leaving a 2-seeded capsule, as in *Spermacoceæ*. *Hamelieæ* differ from *Spermacoceæ* in having a many-celled ovary with numerous ovules in each, while they are themselves separated from *Guetardeæ*, which also have a many-celled ovary, by the latter having few or solitary ovules.

The *Cinchoneæ* have two-celled capsules and numerous ovules, like Hedyotideæ, but their seed are winged. *Gardineæ* have also 2-celled ovaries and many ovules, except in Gardenia itself, which has a 1-celled ovarium, and numerous seed attached to several, usually 4, parietal placentæ, and, as forming an exception to the structure of the tribe, ought not to have been selected for the name, implying that it is the typical genus.

In some of the genera of this section the seed are flattened and pendulous from the apex of the cell lying over each other like tiles, or imbricated. In the *Coffeeæ* tribe the ovary is 2-celled with a single ovule in each, but the direction varies, being pendulous, erect, or peltate, affording, according to the direction, good generic characters. From this imperfect enumeration of variations in the structure and contents of the ovarium it will be seen that, beyond its being adherent, good ordinal characters cannot be obtained from that organ, neither can they be taken from the mature fruit, which is capsular, baccate, drupaceous or, like those of *Umbelliferæ*, a cremocarp, the distinctive mark of the section *Pæderieæ*, including *Lygodysodea*, which genus has, by some Botanists, been most improperly separated as the type of a distinct order.

Notwithstanding such diversities of structure in these most essential organs—the ovary and mature fruit—this is admitted by all Botanists to be a "well-marked and strictly limited order." It is in truth a most natural one, readily distinguished from all others by three easily-observed marks, but which must all be present to constitute a genuine Cinchonacious plant. These are an adherent ovarium—monopetalous corolla—and opposite entire leaves with intermediate stipules. *Caprifoliaceæ* have a monopetalous corolla, adherent ovarium, and opposite entire leaves, but no stipules: so that they may be looked upon as *exstipulate Cinchonads*. *Loganiaceæ* have a monopetalous corolla, opposite leaves and stipules, but a free ovarium; they therefore are equally related, being only separated by a single distinctive mark, the free, not adherent ovarium, hence they, in like manner, may be looked upon as *inferior* flowered *Cinchonads*.

This order, viewed as a whole, furnishes a striking example of the value a constant character, even when solitary, in the limitation of natural families. Here we have a family, including not fewer than 2500 species, kept together as one by the constant presence of opposite leaves

and inter-petiolar stipules. Were we in this instance constrained to take our ordinal characters from the fructification from which the best characters are for the most part obtained, this order would require to be divided into nearly as many orders as it now contains tribes. The capsular fruit and minute, often almost pulverulent, winged seed of *Cinchoneeæ*, but for the opposite, entire leaves and intermediate stipules common to both, would ill associate with the indehiscent, occasionally hard and woody fruit, and globose, stony seed of *Gardenieæ*, which is still further distinguished by the twisted æstivation of the corolla. Neither would the numerous-seeded, two-celled capsules of *Hedyotideæ* associate with the solitary-seeded cells of *Coffeeæ*, &c., but here again the opposite leaves and inter-petiolar stipules supply the connecting link, and allow of our applying these variations of the reproductive organs to the construction of well-defined and natural subdivisions.

Whether the fullest advantage has been taken of the facilities thus afforded, is a point on which my comparatively limited acquaintance with the order, does not permit me to decide, though I think more might have been made of them. But still, as they now stand, the difficulties to be overcome, in making out a genus in the long list of nearly 270 genera appertaining to this family, are not very great.

As stated above, the nearest relations of this order are *Caprifoliaceæ*, on the one side, and *Loganiaceæ* on the other, each of which might almost be viewed as sub-orders, the former only differing in the absence of stipules, and the latter in having a superior ovary. Lindley considers it very nearly allied to *Compositæ*, the relationship existing between the two orders is not however by any means so obvious to me as he represents. With *Apocyneæ* the points of agreement are numerous, and close, the superior ovary and want of inter-petiolar stipules of the latter being the only ones that keep them distinct. The tribe *Opercularieæ* is a curious one, differing from the rest of the order in having a one-celled ovary with a solitary, erect ovule. These peculiarities, probably, combined with habit, have induced many eminent Botanists to view this tribe as distinct from *Rubiaceæ*, but in this respect it simply bears the same relationship to *Cinchonaceæ* that *Viburnum* does to the many-seeded *Caprifoliaceæ*, so cannot be considered distinct.

The tribe *Stellatæ* was long ago removed from the order by Lindley, for the same reasons that *Caprifoliaceæ* has been by other Botanists, the want of stipules. The correctness of this view has been confirmed by that most accurate observer, the late Mr. Griffith, who long ago pointed out to me, in the course of our correspondence, that they have no corolla, the flower of this tribe being similar to that of *Nyctagyneæ*, namely a calyx with a herbaceous tube, embracing the ovary, and an expanded petaloid limb. This of course settles the question. DeCandolle and most other Botanists consider the verticel of leaves so constant in this tribe as consisting of one pair of true leaves, and the intermediate ones as diluted, leaf-like stipules. This position is met by Lindley in the following terms: "To this verbal, but not real distinction there is this objection which I conceive quite fatal to it. If a part of the leaves of each whorl of *Galium* were stipules, they must bear a certain proportion to the true leaves; suppose the whorl to consist of two leaves, each will have two stipules, and consequently the whole number of parts in each whorl must be six, and in all cases the number must be some power of three. But of the first forty species of *Galium*, in DeCandolle's Prodromus, only 13 conform to this rule, and the frequent tendency of whorls to vary from 4 to 6, or from 5 to 6, or from 6 to 8, seems to me an incontrovertible proof that the apparent leaves of *Stellatæ* are true leaves and not a modification of stipules."

Since writing the preceding remarks, Dr. Lindley's Vegetable Kingdom, one of the noblest contributions to Botany of the present century, has reached me, in which, under the article Galiaceæ, he has examined, in detail and I think with even more than his usual ability, this question. I shall therefore here drop the subject, and under the same heading reproduce the article in his own words as being much more to the point than any thing I could substitute in their place. A sub-order might possibly have served the purpose, but to have adopted that course would virtually be breaking down the whole order which, as already shown, is heterogeneous in its elements, and only held together by the solitary, but constant character of inter-petiolary stipules.

Geographical Distribution. The true *Cinchonaceæ* constitute a peculiarly tropical assemblage of plants, being almost exclusively confined to the tropics or the warmer regions on either side. Within these limits the species so abound, that it is estimated they amount to about 1-30th of the flowering plants, a calculation which I think will be found very near the truth, and which, as applied to the Indian Peninsula, will raise the estimated flora to about 5000 species, as there are 154 named in our Prodromus, and my present collection exceeds that number by more than 15 species, which would be required to make good the calculation. In Europe no true Cinchonaceous plant is indigenous, their place being occupied by the *Stellatæ*, of which the European flora includes about 100 species.

In the tropics and warmer regions on either side, they are met with in all countries, but are, as compared with Asia and America, rare in Africa. In India, species extend as far north as the 30th or 31st degree of latitude, and there, we are informed by Dr. Royle, a few of the herbaseous forms are met with during the moisture of the rainy season at an elevation of 6000 or 7000 feet, an elevation which, as regards temperature, must furnish a climate cooler than the south of Europe in the 36° of latitude, a circumstance showing, that, however much temperature may and does affect the distribution of plants on the surface of the globe, climate also has much to do with it. The following extract from my Neilgherry Plants, recently published, may not be uninteresting to some of the readers of this work.

"The predilections of this family as regards temperature, are decidedly tropical, or sub-tropical, not a single species, excluding *Stellatæ*, being, so far as I am aware, indigenous even in the South of Europe, while within the tropics they are estimated to constitute 1-30th of the flowering plants. At this rate, and assuming that on the higher ranges of these hills there are 1000 species of flowering plants which, including grasses and rushes I dare say is near the truth; then there should be 33 species of *Rubiaceous* plants. This may be somewhat beyond the truth, but I rather think, including Stellatæ, it is under the actual number now in my herbarium, which however I have not counted. Assuming that these two estimates are each approximations to the truth, they go far to show that the climate of the hills partake more of the tropical character than some of the examples previously adduced would lead us to expect, and that although an immense improvement on that of the plains, we must still view it as very inferior to even the South of Europe, as a temperate climate, unless it can be shown that the temperature is modified in its effects on the constitution by our very rarified atmosphere, requiring a greater volume of air, by probably nearly ¼, to be respired to yield the same quantity of oxygen to the circulation, that would be obtained in a similar temperature on the level of the sea. This is not the place to consider what effect this difference may have in modifying health and disease, though it seems quite in place to direct attention to the circumstance in connection with facts deduced from a consideration of the natural products of the region."

The subject here adverted to is one which I am of opinion has not received the attention, in a purely medical point of view, it seems to merit, which is my reason for alluding to it here in a work professedly in a great measure medical, and which is in the hands of so many of the profession.

DeCandolle has distributed about 1600 species described in his Prodromus under 13 tribes. Species referable to 10 of these appertain to the Flora of India and the Eastern Islands, a fact showing both the richness of our flora in this family, and its marked tropical tendency. I have not ascertained the relative proportion which the Indian ones bear to those of the rest of the world, but I presume it is at least equal to that of America, and greatly in excess of what has been found elsewhere. From these facts, combined with the similarity of climate in which the Cinchonas of America is found as compared with many of the Alpine climates of India, Dr. Royle suggests the propriety of attempting their introduction into India. The proposal seems feasible enough, and, considering the vast quantities of Bark and Quinine annually consumed in India, it seems well deserving of a trial and, if successful, would unquestionably be conferring a vast boon on India, as none of our native products, so far as yet known, can be considered a substitute. Many plants have been tried as substitutes, but hitherto with very indifferent success.

Properties and Uses. It has been remarked above that this, in its economical relations, is a most important family. To it we are indebted for the justly-famed Peruvian Bark. Bitterness and astringency are properties very extensively met with in this family, more or

less combined with an aromatic. It was long supposed that the febrifugal powers of the different kinds of Peruvian Bark were owing to the combination of these qualities, and it was not until chemists detected the existence of two alkaloids, Cinchonine and Quinine, both of which, but especially the last, was soon ascertained to possess febrifugal powers far beyond the material from which it was extracted, though separated from all vegetable matters with which it was originally in combination; showing beyond dispute that these barks were indebted to this single ingredient for their power of arresting the progress of fever and removing the peculiar and inexplicable tendency, long observed in the human constitution, to periodical returns of certain forms of disease. The laws which govern this tendency to periodical renewal of certain abnormal actions are still undiscovered, but extensive experience has proved that they are more safely and effectually controlled by the salts of Cinchona than by any other known agent. Much has been written on the species of Cinchona, that yield the different kinds of bark from which these salts are obtained, but I believe the most recent and best exposition is to be found in Lindley's Flora Medica, which in a brief space puts us in possession of an excellent summary of all that is yet known on the subject. It would of course be a waste of space for me to go into the subject in a work on Indian Botany, a country in which not one genuine species of Cinchona is found. All the indigenous trees that have been so named are generically distinct; our nearest allies being *Hymenodictyon* and *Luculia*, both of which were formerly considered Cinchonus. The inner bark of one species of *Hymenodictyon*, *H. excelsum*, possesses the bitterness and astringency of the Peruvian Bark, but I am not aware of its having been used as a substitute. An Eastern tree, *Uncaria gambier*, yields a very astringent extract, resembling Catichu, and supposed to be occasionally exported to Europe as such. *Ipecacuana* is another of the products of this family and, as a medicinal agent, certainly ranks next Cinchona as affording a most valuable medicine peculiarly well adapted for the treatment of chronic bowel complaints, when administered in large doses. In some forms of diarrhæa it seems to lose its emetic qualities and requires, to produce a marked effect on the disease, to be administered in doses of from 15 to 20, or even 30 grains, and these repeated at comparatively short intervals. Such cases are however of rare occurrence, except among convicts in jails, where confinement and the depressing passions, acting on a depraved constitution, give rise to the most fatal forms of intestinal disease. In the more usual and milder forms of diarrhæa and dysentery, small and frequently-repeated doses in various combinations with opium and mercury, are found more suitable.

Of the Indian species of the family, one or two are reported to possess somewhat similar properties, as for example the *Randia dumetorum*, but nothing certain is known regarding them. The plant supposed to supply the Mungoose with its antidote against the bite of the snake, is a member of this family, and has been called from the circumstance *Opiorhiza Mungos* (Mungoose snake root). It is a native of both the Continent and Islands, but is by no means common in India. The root is intensely bitter, more so even than Gentian. Ainslie alludes to a tree under that name, the leaves and bark of which, he says, are made into a decoction by the Cingalese and administered in cases of snake-bite. If he is correct in calling it a tree, it cannot be the plant so called by Botanists, which is a small shrub, or rather an annual with a perennial root, which seems to die down to near the root after ripening its seeds. There are many species of the genus greatly resembling each other, but all, so far as I have seen, small suffruticose plants. It is common in Malabar during the rainy season, but rare on the Coromandel side of the hills, except where exposed to the Southwest monsoon. In the woods of Courtallum it is frequent.

As aliments a few species are in use. Among these Coffee occupies the first place, and its culture is now, most deservedly, engaging much attention in this country as an article of commerce. According to Roxburgh the leaves of *Canthium parviflorum*, a common thorny shrub, are largely consumed by the natives in their curries. I am not otherwise aware of the fact. The pulp enclosing the seed, he also informs us, is eaten by the natives. This I can readily believe, but to the European taste, it is not very palatable. The fruit of another plant of the family *Vanguria edulis*, a Bengal plant, is also eaten by the natives. This tree I have never seen growing.

In the arts several species are employed. The roots of *Hedyotis umbellata*, *Rubia munjista* and of *Morinda tinctoria*, all yield a red dye; that of the first, when well managed, one of remarkable brightness and durability. Madura is famous for its turbands so dyed. The plant is

very common every where, but it is only in the sandy soils near the sea coast, where the roots penetrate to a great depth, that it is either dug or cultivated. In some districts it is largely cultivated, but does not, I believe, generally yield a profitable crop. In Tanjore, the *Morinda* is also cultivated for the sake of its roots, but I believe only to a small extent, as the colour it yields is a dull, brownish red. *Nauclea cordifolia* attains a large size, and affords a close-grained timber, but of inferior quality. It is of a yellowish colour, and in the Paulghaut jungles is, with reference to that peculiarity, called Mungie cadumbee. Two species of *Hymenodictyon* are natives of these jungles: one of them attains a large size, furnishing the timber known in this part of India, under the name of Bastard Cedar, and is a good deal used by the Cabinet makers of Paulghaut. It is soft, easily worked, of a redish mahogany colour, but wants the close grain of that wood. It is the *H. excelsum* of our Prodromus, but not of Roxburgh. In my Icones, I have published a figure of it under the name of *H. obovatum*, but have since discovered that it is not that species, and have now called it *H. utile*, with reference to the purposes to which it is applied. According to Roxburgh, the wood of *H. excelsum* "is firm, close-grained, of a pale mahogany colour, and very useful for many purposes." This description is in all respects applicable to my *H. utile*, except that it is light and not very close-grained, and has so strong a hygrometric tendency as considerably to impair its usefulness for some purposes.

Remarks on Genera and Species. Under this head I have on some former occasions expressed my belief that reduction of the number of genera is wanted, and suggested that in some instances this might be effected through the exclusion of non-essential points from our generic characters, by which they are often extended, especially in small genera, to a most perplexing length, while at the same time their precision is lessened. The order under consideration has not escaped the prevailing fashion, and many of the genera seem such as might be dispensed with. M. Ach. Richard, in his excellent "Memoire sur les Rubiaces," states it as his opinion, that in the present state of Botany reductions in the number of genera and families are more wanted than additions, on the ground that many genera are often founded on modifications so slight, that they readily pass into each other and are consequently altogether artificial.

It is to be wished that such sentiments were more prevalent among Botanists, as they might tend to bring about a reform by inducing them to study orders more carefully and extensively before constituting new genera. These should be based on a thorough knowledge, not only of the structure of the plant in hand, but of all its nearest allies, lest perchance we should have a mere variety in place of a species under examination. Accidents of this kind cannot be always avoided, but as all Botanists are aware of the tendency of plants to vary in their forms, it behoves them to be so much the more cautious.

There is an anecdote told of the late eminent and, justly, much esteemed Botanist, Sir J. E. Smith, having discovered, to his infinite chagrin, that he had constituted three genera out of two species. It is not difficult to understand how such things may happen, should we chance to be describing plants belonging to an order with which we are imperfectly acquainted, or in which we have unfortunately assigned too high a value as regards constancy to parts liable to variation, or have attached undue importance to unessential ones which have been introduced into the generic character.

There is scarcely a page in Endlicher's Genera Plantarum (at least among the Dicotyledonous orders), that does not furnish examples of the introduction of unessential points of character liable to mislead in that way. Let us take one. *Hamelia* is thus defined: "Calyx tubo ovali, cum ovario connato, limbo supero, brevi quinquelobo, lobis erectis acutis. Corolla supera tubulosa, tubo subpentagono, fauce nuda, limbi breveter quinquelobi, lobis æqualibus vix patentibus," &c. Are we to infer from this that, if another species, agreeing in other really essential points, were discovered having the lobes of the calyx reflexed and acute, it must be excluded from this genus, or must every species of *Hamelia* have a 5-angled corolla, a naked throat, a short, 5-lobed limb, with the lobes scarcely expanding? If such must be the case, is seems probable enough that, small as the genus is, 10 species, some of these must be excluded. If these characters are not to be taken in this strict sense, then for what purpose are they introduced into the body of the generic definition, rather than into the natural character at the end where greater latitude is allowed. Their being so introduced must have a tendency to mislead as more importance is thereby attached to them than they merit.

So long as this fashion continues in Botany, and to my mind it merits no better name, our genera must go on increasing, until almost every other species becomes the type of a genus, as it seems scarcely possible to find half a dozen species, even in large genera, agreeing in so many minute and unessential points, though dozens may associate in all others of really generic value. This position seems to derive some support from the fact, that the first 120 genera of Rubiaceæ, in DeCandolle's Prodromus, give an average of about $6\frac{1}{2}$ species to each; while the same number of genera of Compositæ, give nearly 12, though that order, also, has been abundantly split into small genera. That fewer would suffice I do not venture to assert, but, tried by this standard, it certainly seems that the number of genera is large in proportion to the species. On this subject Richard remarks, that "very often a genus is established, because a species under examination presents some modification not found in another, or which had been overlooked by the author who first traced the generic character, an event which must almost unavoidably happen in all cases where there are but a small number of species in a genus or genera in a family to study." Carefully studied characters, excluding all mere specific distinctions, or at least only introducing them into the natural character, will go far towards remedying this evil, which is gradually assuming so serious a form, that it is to be feared a re-action will take place and lead us into the opposite extreme.

Richard further observes, that had such been his object, he could easily have acquired brilliant eclat by constructing a number of new genera, but that he preferred modifying and extending the characters of old ones, so as to make them admit species presenting only slight modifications; thus voluntarily depriving himself of the renown to which authors of Monographs generally attach much importance. For such a sacrifice on his part we ought to feel thankful, as such is the foundation on which a perfect natural system must ultimately be raised.

To facilitate the investigation of plants of this order, I have copied, with some slight modifications, from DeCandolle's Prodromus, a conspectus of the tribes and sub-tribes under which he has arranged the genera, so far as it is applicable to the Indian Flora. The tribes are illustrated in the accompanying plates, and several of the sub-tribes are also of course represented by the same figures. Some of the analyses, I now regret to find, are not so perfect as I could wish, owing to pressure of other occupations, at the time they were sent to the press, preventing my re-examining the labours of the draftsman, in whose skill I find I have occasionally reposed too much confidence.

§ 1. Ovary 2–6-celled, cells many-seeded.	
A. Ovary 2-celled, fruit capsular, seed winged.	CINCHONACEÆ.
a. Flowers capitate, sessile on the globular receptacle.	Naucleæ.
b. Flowers racemose or spicate, pedicelled.	Cinchoneæ.
B. Ovary 2- or rarely 1-celled, with parietal placentæ, fruit indehiscent, seed not winged.	GARDENIACEÆ.
a. Flowers and fruit sessile, densely capitate, ovary 2-celled.	Sarcocphaleæ.
b. Flowers distinct, not capitate, ovary 2-celled.	Randieæ.
c. Flowers distinct, ovary 1-celled, placentæ parietal.	Gardenieæ.
C. Ovary 2-celled, fruit capsular, dehiscent, seed not winged.	HEDYOTIDEÆ.
a. Stipules solitary, or 2 on each side, neither sheathing nor bristle-toothed.	Rondeletieæ.
b. Stipules sheathing at the base, bristle-toothed.	Hedyoteæ.
D. Fruit baccate, many-celled.	HAMELIEÆ.
E. Fruit drupaceous, nuts several, many-seeded.	ISERTIEÆ.
§ 2. Ovary 2- or several-celled, cells one, or rarely 2-seeded.	
A. Ovary 2–10-celled, cells 1-seeded, fruit drupaceous.	GUETTARDACEÆ.
a. Flowers and fruit sessile, congested into a dense capitulum.	Morindeæ.
b. Flowers distinct, more or less pedicelled.	Guettardeæ.
B. Ovary 2-celled, fruit indehiscent, scarcely fleshy, splitting into two carpels, carpels flattened on the back, pendulous from a filiform axis, (cremocarps).	PÆDERIEÆ.
C. Ovary 2-celled, fruit baccate, convex on the back, more or less furrowed on the inner surface.	COFFEACEÆ.
a. Flowers distinct, pedicelled, or rarely capitate.	Coffeeæ.
b. Flowers aggregate, capitate, bractiated. (I have a species of Pavetta referable to this section.)	Cephalideæ.

NAUCLEA PARVIFOLIA (ROXB.)

D. Ovary 2–4-celled; fruit 2–4 nuts (pyrens); stigma bilamellate.	SPERMACOCEÆ.
a. Flowers and fruit sessile, densely aggregated on a globular receptacle.	Cephalantheæ.
b. Flowers not sessile, on a globular receptacle, fruit dry, 2–4-partible.	Euspermacoceæ.
c. Fruit somewhat fleshy, not partible.	Putorieæ.
§ 3. Ovary 1-celled, with a single ovule.	
A. Fruit adhering, laterally capitulate, afterwards dehiscing, 2-valved.	Opercularieæ.
B. Fruit dry, indehiscent (winged with the persistent lobes of the calyx).	Jackiaceæ.

N. B. Opercularieæ have not, so far as I am aware, been found in any part of India, and *Jackia* has only been found in the Eastern Islands, they are therefore introduced merely as examples of the 3d section.

The Flora of India and the neighbouring Islands furnishes representatives of all these divisions and sub-divisions, except *Cephalideæ* and *Opercularieæ*. Stellatæ, for the reasons given above, I have excluded. They are, however, easily known by their verticelled leaves, bi-partible fruit and capitate stigmas. Hamelieæ is scarcely known in the Continental Flora, I have however one species forming the type of a new genus. (This I have dedicated to Mr. Law, of the Bombay Civil Service, an honour well merited, by his assiduity in investigating the Flora of that portion of India, amidst the interruptions unavoidably incident to one in his situation.) Two or three species of *Axanthus* are natives of Ceylon, and several others of Malacca, where *Urophyllum* is also indigenous. *Pæderieæ* are rare in India, but *Pæderia fœtida* is occasionally met with in gardens in the South of India, and is a native of Bengal. From Assam I have specimens of a species *Lygodysodea*, a genus first discovered in South America.

Of the genera described in our Prodromus, I suspect two, *Griffithia* and *Grumilea*, must ultimately be reduced; and our *Santia* I have already (Calcutta Journal of Nat. History) referred to *Lasianthus*. Jack. *Mephitidia*, D. C., *Griffithia*, it now appears to me, can scarcely be kept distinct from *Randia*, the points of separation between these genera appearing of specific or possibly sectional, rather than generic value. As, however, it has been adopted by all subsequent writers, it is not my intention to disturb their decision. With regard to *Grumilea*, it appears that, in a practical point of view, the distinction between it and *Psychotria* is of very secondary value, whatever it may be in a physiological, not being supported by habit or any available difference by which a herbarium specimen, not provided with ripe fruit, can be distinguished. The only difference between the two genera is, *Grumelia* having ruminated albumen while *Psychotria* has plain. If both genera are to be maintained, I suspect many of the present species of *Psychotria* will, in course of time, change their name, at least several of those in my Herbarium were, in the course of a recent examination, so transferred, though, judging from general appearances and characters, I should never have suspected them to be *Grumelias*, and, but for the circumstance of my specimens being furnished with seed sufficiently mature to enable me to determine the point by dissection, could not have discovered that they were so.

In the accompanying plates, five of the above Tribes have been illustrated, not quite so neatly as I could have wished, a defect originating in the then deficient skill of the workmen employed, but which subsequent practice has done much to remedy. I therefore trust that, for the future, the plates will be better calculated to please the eye, as well as more instructive, by their more comprehensive analyses.

Since 1841, when the preceding part was published, many additions have been made to the Order, most of which are published in my Icones, to which I beg leave to refer for both figures and characters.

EXPLANATION OF PLATE 123.

1. *Nauclea parviflora.*
   Flowering branch, natural size.
2. Detached flower.
3. Corolla split open.
4. Anthers, back and front.
5. Ovary and calyx, with the style and stigma.
6. Ovary cut transversely (not good).
7. Mature fruit detached.
8. Mature fruit cut transversely.
9. Detached capsule, showing its mode of dehiscence from the base.
10. Capsule cut vertically.
11. Seed as seen after the separation of the capsule.
12. Detached seed.
    All more or less magnified.

EXPLANATION OF PLATE 124.

1. *Mussænda frondosa.* Flowering branch, natural size.
2. Detached corolla split open.
3. Ovary, style, and stigma, with the calyx partially removed.
4. Anthers, back and front.
5. Ovary cut vertically.
6. —— cut transversely.
7. An immature fruit.
8. —— cut transversely.
9. Detached seed.

All more or less magnified.

EXPLANATION OF PLATE 125.

1. *Hedyotis Leschenaultii.* Flowering branch, natural size.
2. Corolla split open.
3. Ovary, style, and stigma.
4. Anthers, back and front.
5. Ovary cut vertically; and 6. transversely, but in both cases the ovules badly represented, as if there were only one, in place of many.
7. Capsule, natural size.
8. —— magnified.
9. —— cut vertically.
10. A detached seed.
11. A detached stipule.

EXPLANATION OF PLATE 126.

1. *Morinda bracteata.* Flowering branch, natural size.
2. Corolla split open, throat hairy.
3. Anthers, back and front.
4. Ovary, style, and stigma.
5. ——cut transversely.
6. Full-grown fruit, cut transversely.
7. Detached seed.
8. Cut transversely; and 9. vertically, showing the embryo in situ.
10. Embryo detached.

All more or less magnified.

EXPLANATION OF PLATE 127.

1. *Psychotria ambigua.* Flowering branch, natural size.
2. Corolla split open.
3. Anthers, back and front views.
4. Ovary, style, and stigma.
5. —— cut vertically.
6. —— transversely.
7. A mature berry.
8. —— cut transversely.
9. Detached seed.
10. One seen from within.
11. —— cut transversely.

All more or less magnified.

EXPLANATION OF PLATE 128.

1. *Knoxia corymbosa.* Natural size.
2. Corolla split open.
3. Stamens, back and front.
4. Ovary, style, and stigma.
5. —— cut vertically.
6. —— transversely.
7. A mature capsule.
8. —— cut transversely.
9. Seed and capsule cut vertically.
10. Detached seed cut vertically, showing the embryo in situ.
11. Embryo detached. All more or less magnified.

LXXXIV.—GALIACEÆ. *Stellates.*

Diagnosis.—*Cinchonal Exogens, with epipetalous stamens, straight anthers, bursting longitudinally, didymous fruit, and verticillate leaves without stipules.*

Herbaceous plants, with whorled leaves, destitute of stipules, and angular stems. Flowers minute. Calyx superior, obsolete, or 4–5- or 6-lobed. Corolla monopetalous, valvate, rotate, or tubular, regular, inserted into the calyx; the number of its divisions equal to those of the calyx. Stamens equal in number to the lobes of the corolla, and alternate with them. Ovary peltate or 2-celled; ovules solitary, erect; styles 2; stigma simple. Fruit a didymous, indehiscent pericarp, with 2 cells and 2 seeds. Seeds erect or peltate, solitary; embryo in the axis of horny albumen; radicle inferior; cotyledons leafy.

There can be little doubt that the inconspicuous weeds of which this Order is composed, have as strong a claim to be separated from Cinchonads, as that Order from Caprifoils. It is true that no very positive characters are to be obtained from the fructification, but the want is abundantly supplied by the square stems and verticillate leaves without stipules, forming a kind of star, from which circumstance the name Stellate is derived.

வெள்ளிமடந்தை
Velleemadentha

MUSSÆNDA FRONDOSA (γ) (LINN.)

Rungiah. del. Winchester. Lith

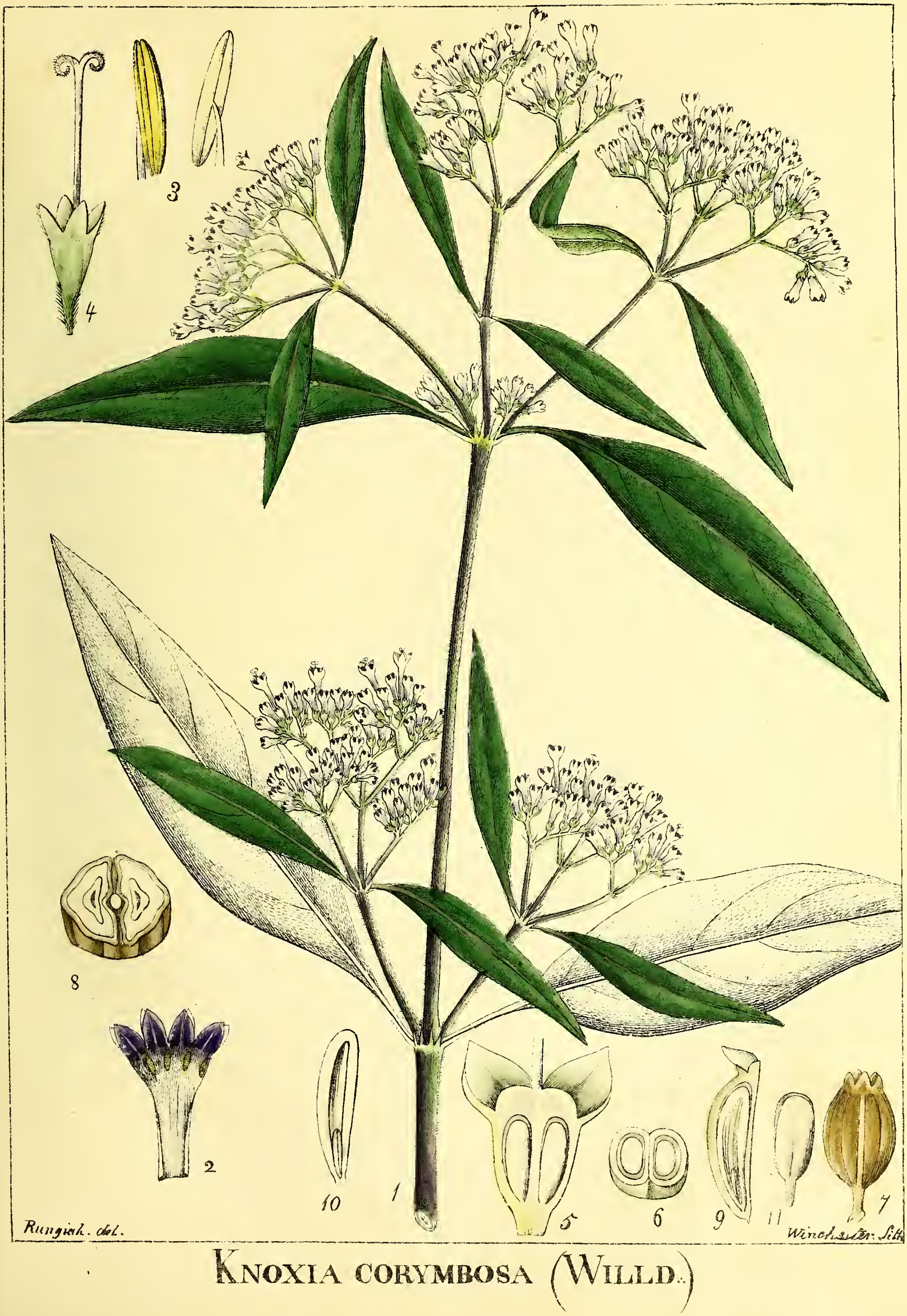
HEDYOTIS (ANOTIS) LESCHENAULTIANA (W&A)

நோணாமரம்
Nonamarum } Tam

MORINDA BRACTEATA (ROXB.)

మూలగమానూ
Moolagamanoo } Tel

PSYCHOTRIA AMBIGUA (W. & A.)



KNOXIA CORYMBOSA (WILLD.)

Nevertheless Botanists, in most instances, appear to be against this opinion: I confess I cannot conceive upon what grounds. Usually a material dissimilarity in habit, if accompanied by any clear character, whether of vegetation or fructification, is considered sufficient for the separation of a group of plants into two Orders; in this case the weak, angular stems cause a peculiarity of habit that cannot be mistaken, and the total absence of stipules, to say nothing of the didymous fruit, affords a certain mark of recognition. Surely there is some inconsistency in separating, by the absence of stipules, Caprifoils, which are undistinguishable in habit, while the very same character is rejected when applied to an assemblage of genera all distinctly combined by their habit. The only ground upon which this is intelligible, is that taken by DeCandolle and others, who consider the apparent leaves of Stellates to be in part true leaves and in part leaf-like stipules. To this verbal, but not real distinction, there is this objection, which I conceive quite fatal to it: If a part of the leaves of each whorl in Galium was stipules, the latter must bear a certain proportion to the true leaves; suppose the whorl to consist of two leaves, each will have two stipules, and consequently the whole number of parts in the whorl must be six, and in all cases the number must be some power of 3. But of the first forty species of Galium, in DeCandolle's *Prodromus*, only thirteen conform to this rule; and the frequent tendency in the whorls to vary from 4 to 6, or from 5 to 6, or from 6 to 8, seems to me an incontrovertible proof that the apparent leaves of Stellates are true leaves and not a modification of stipules. To this it may be added, that the admitted leaves are so entirely the same as what M. DeCandolle conceives to be stipules, that no difference whatever can in general be found in their form, colour, anatomy, or degree of development. Such reasons have, however, not proved satisfactory to Botanists, who with one accord appear to range themselves upon the side of M. DeCandolle; and recently the question has been more particularly agitated by one of the most distinguished writers of this country.

Mr. Bentham, in an article on Crusea rubra, published in the *Botanist*, page 82, after entering at some length and with great skill into a discussion of the arguments employed on both sides of the question, has decided in favour of the opinion of DeCandolle, that a part of the apparent leaves of Stellate plants are stipules. The grounds upon which he has arrived at this conclusion are essentially the following:

1. That the foliaceous organs in Stellates, if viewed as consisting entirely of leaves, do not bear that relation to the angles of the stem which is usual in Dicotyledons; but that the relation becomes apparent if only two of them are taken as leaves and the rest as stipules. (DeCandolle seems influenced by the consideration that it is only two of the apparent leaves which have buds in their axils; but Mr. Bentham does not advert to this.)
2. That in a number of cases, especially in Asperula, two opposite leaves are much larger than the others.
3. That in Spermacoceæ and other tribes of Cinchonads, the stipules are connected with the petiole of the leaf into a sheath, and that this sheath exists in Stellates.
4. That the number of parts in each whorl is not necessarily some power of 3, but that, taking two of the parts for leaves, it is immaterial by what number of similar parts those two are separated, because the intermediate processes are analogous to the setæ of Spermacoceæ, the number of which is variable.

Perhaps this question is more important in appearance than in reality, for in some respects it is a mere difference about words; stipules being rudimentary leaves, and leaves developed stipules. It is, however, connected with some points of speculative interest, especially as regards systematic Botany, and therefore I avail myself of the present opportunity of stating what I conceive to be the objections to Mr. Bentham's line of argument, and why I still retain my original opinion upon the subject.

1. With regard to the relation borne by the leaves to the angles of the stem, it is to be observed, that if those foliaceous organs only which are opposite the angles are said to be leaves in Stellates, and the rest stipules, then we must suppose that Labiate

plants have no leaves, but stipules only, for in that and similar Orders the apparent leaves are never opposite the angles of the stem, but are always placed between them. Nor do I find that the number of angles in the stem of verticillate plants necessarily corresponds with the number of their leaves; for example, in Dysophylla stellata, where the whorls often consist of ten parts, the stem has still but four angles. Neither can it be admitted that bodies which do not form branches in their axils are therefore not leaves. All foliaceous organs, of whatever kind, and especially stipules, possess that power or not, according to circumstances, as is too well known to require particular proof. Besides, DeCandolle's statement is not sustained by fact; for in Asperula the uppermost branches, bearing flowers, are frequently produced alternately with the leaves that form the node from which they spring, and consequently must, in such cases, arise from the seat of one of the supposed stipules. It is more probable that the development of branches from a portion only of the leaves, is connected with the form of the stem, and the relation which the leaves bear to each other. If the form of the stem requires an alternate developement of a pair or a triplet of opposite branches, then the first whorl in which the development takes place, will settle the origin of all that succeed it. For example, if in one whorl of six leaves, the first, third, and fifth leaves produce axillary buds, then in the whorl next above it, the second, fourth, and sixth leaves will probably be gemmiferous, according to the ordinary laws of decussation. It is plainly impossible to say that what seem to be leaves are in reality stipules, because they have no axillary buds; for if that opinion were maintained, it would be necessary to assign the quality of stipules to a certain portion of the leaves of such verticillate plants as Dysophylla stellata, in which only a part of the whorls ever produces branches.

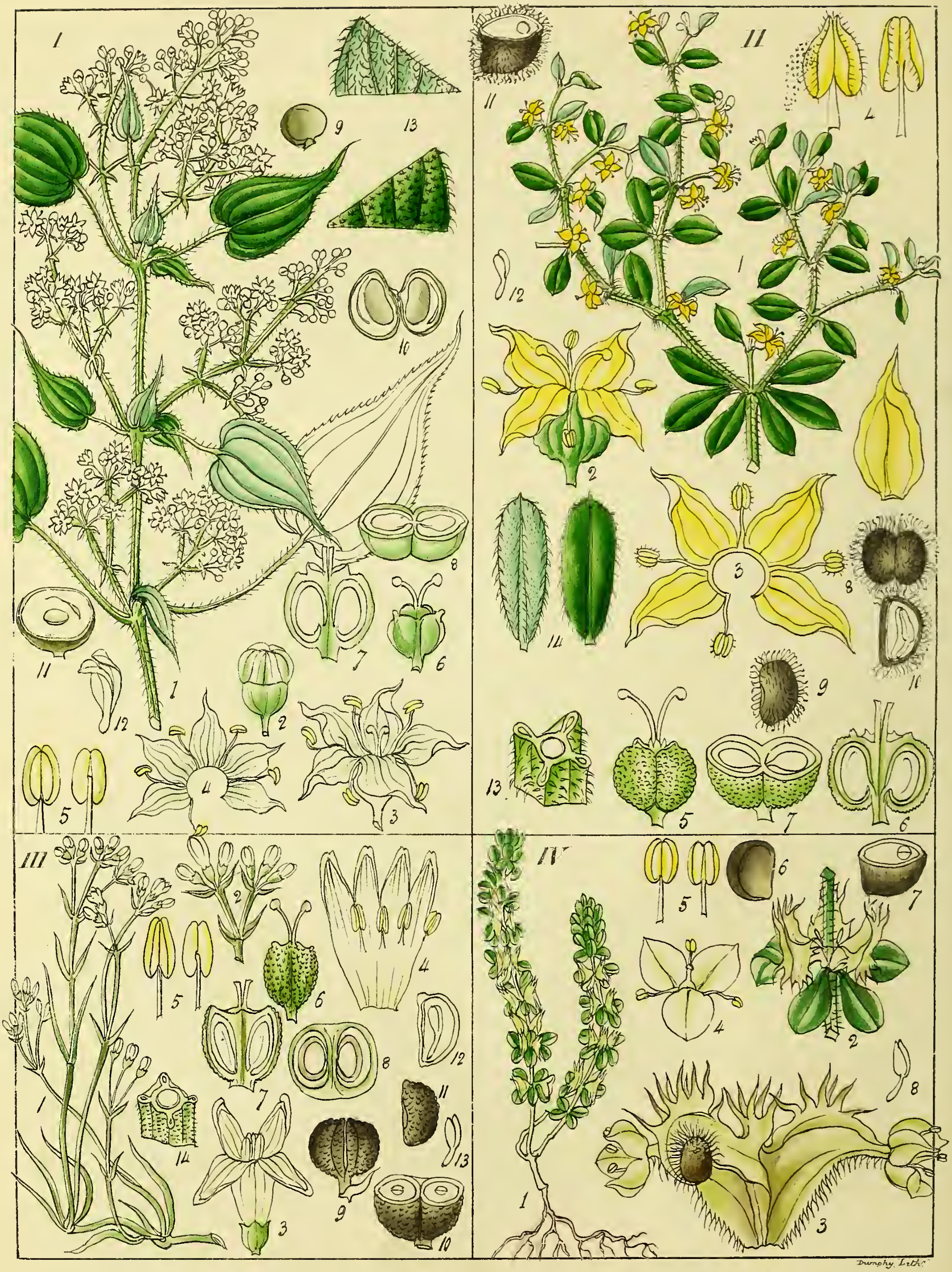
2. If it is true that in Asperula two opposite leaves are frequently longer than the others, that circumstance may be reasonably ascribed to the greater development consequent upon their higher functions, and to their peculiar position on the stem; and it is equally true that in the greater part of Stellates no trace whatever of any kind of difference between the leaves can be detected, as is most remarkably the case in those surrounding the flowers of Crucianella maritima.

3. The argument derived from the occasional connection of the leaves by a membrane can hardly be allowed much weight, when it is remembered that in such cases the intermediate leaves are less like stipules than in those cases where no membrane exists; compare Asperula cynanchica, or litteralis, or longiflora, with such genuine Crucianellas as C. maritima.

4. The comparison of the supposed stipules of Stellates and the setæ of Spermacoceæ is inadmissible, because the former are at all events single, simple organs, be they what they may, while the setæ of Spermacoceæ are the result of the splitting of two parallel-veined stipules, and therefore will necessarily be uncertain in number.

These arguments do not, however, by any means exhaust the question; and therefore I proceed to make a few additional remarks upon a point not yet adverted to. It is in Asperula, more than in any other genus of the Order, that is to be found evidence favourable to the supposition of M. DeCandolle, and his followers. In A. longiflora, cynanchica, and some others, the lower whorls are in the usual state, but the upper ones are reduced to two perfect leaves, with one or sometimes two teeth or subulate processes between them, which remain. In this condition the structure of Asperula is so very like that of many Spermacoceous plants, that the analogy between them seems indisputable; and I presume that it was such cases which first led to the theory under consideration.

It is, however, to be remembered, that in Stellates the supposed stipules are always what first disappear in the process of reduction in the number of foliaceous appendages; but that in Cinchonads it is in many cases the leaves which are first lost when such a reduction takes place. The latter fact is readily verified upon reference to any of the capitate Spermacoces, where the bracts are evidently stipules, and especially to S. calyptera, in which the leaves are gradually merged in the large membranous cup that subtends the flowers, while the stipules suffer no diminution. The same circumstance may be observed in several Brazilian Cinchonads allied to Psychotria barbiflora, and in Pæderia fœtida. It is also pos-



Dunphy, Lith.

I. RUBIA CORDIFOLIA _ II. GALIUM ASPERIFOLIUM.
III. ASPERULA CYNANCHICA _ IV. VAILLANTIA MURALIS.

sible that the large coloured involucrum of cephaëlis is, at least in some cases, formed by the excessive development of stipules and suppression of the leaves, for such is undoubtedly the case in a Sierra Leone plant in my possession, which I presume is the little known C. bidentata of Thumberg. These facts render it more probable than ever that Stellates and Cinchonads are essentially different Natural Orders; for they would seem to show that while the first has verticillate, foliaceous organs, the most imperfect of which have the greater tendency to disappear, the second has verticillate foliaceous organs, the most perfect of which have the greater tendency to become abortive. I need scarcely add, that after a full consideration of this point I retain my original conviction, that the apparent leaves of Stellates are really leaves, and not stipules, and that the Order is as distinct from Cinchonads as Nightshades from Figworts, Verbenes from Labiates, and I might even add, as Cinchonads themselves from Umbellifers.—Sec. Bot. Reg. 1838. 55. To be consistent, then, we must either combine Caprifoils with Cinchonads, or we must preserve Stellates separate. Properly speaking, the appellation Rubiaceæ should be confined to the latter group, as it comprehends the genus Rubia; but that name has been so generally applied to the larger mass now comprehended under the name of Cinchonads, that I find it better to abolish that of Rubiaceæ altogether.

Natives of the northern parts of the northern hemisphere, where they are extremely common weeds, and of high mountainous regions in Peru, Chili, and Australasia.

First among them stands Madder, the root of Rubia tinctoria, one of the most important dyes with which we are acquainted; a quality in which other species of Stellates participate in a greater or lesser degree. The roots of Rubia cordifolia (Munjista, *Roxb.)*, yield the Madder of Bengal, and form even an article of the export commerce to Europe, under the name Munjeeth. Rubia angustissima, from Tong Dong, has also highly-coloured roots, and Rubia Relboun, is the Madder of Chili. It has been remarked that the whole system of animals fed on Madder becomes stained red in consequence. Madder, in addition to its valuable dying qualities, passes for a tonic, diuretic, and emmenagogue. The torrefied grains of Galium are said to be a good substitute for coffee. The flowers of Galium vernum are said to curdle milk. An infusion of Asperula cynanchica has a little astringency, and has been used as a gargle. Asperula odorata, or Woodruff, is remarkable for its fragrance when dried; it passes for a diuretic. Rubia noxia is said to be poisonous. M. Miergues, a French physician, states that he has cured epilepsy with the extract of Galium rigidum, by employing it in doses of twelve grammes for an adult; and he adds that G. Mollugo has been used with success in the same malady."—*Lindley.*

In the accompanying plate, 128–bis, I have endeavoured to throw all the light I am able on the question under discussion, and at the same time give a good idea of the Botanical peculiarities of this group when viewed as a distinct order. For this purpose I have introduced analyses of four genera, two of Indian, and two of European plants. I abstain from any further remarks on the question of separation, leaving the facts to speak for themselves.

In regard to Mr. Griffith's theory, mentioned in the Icones and Neilgherry Plants, that the apparent corolla is merely a coloured calyx, as in *Nyctaginiæ* and *Loranthaceæ*, it may be remarked that, in that case, the stamens should be opposite, not alternate with its lobes, unless we at the same time assume the abortion of one verticel of stamens as in *Primulaceæ*, of which there is no proof, but which, if such were the case, would establish a relationship with Lindley's Cortusal alliance. This I presume will scarcely be admitted.

EXPLANATION OF PLATE 128–*bis*.

I. *Rubia cordifolia*, Linn., or Munjista, Roxb.
1. Flowering branch, natural size.
2. Detached flower-bud.
3. Expanded flower.
4. Detached corolla and stamen.
5. Anthers, back and front views.
6. Ovary.
7. —— cut vertically.
8. Ovary cut transversely.
9. A single mature seed.
10. A mature fruit cut vertically.
11. —— one-half cut transversely.
12. Detached embryo.
13. Upper and under surfaces of the leaves.

All more or less magnified.

II. *Galium asperifolium*, (Wall.)
1. Flowering branch, showing a whorl of 6 leaves, some of three and generally the upper ones reduced to pairs.
2. An expanded flower.
3. Corolla and stamens detached.
4. Anthers, back and front views.
5. Ovary.
6. —— cut vertically, the ovules ascending.
7. Ovary cut transversely.
8. A mature fruit of *G. boreale.*
9. One-half detached.
10. Cut vertically, showing the embryo in situ.
11. Cut transversely.
12. Detached embryo.
13. Portion of the stem.
14. Detached leaves, upper and under surfaces.

III. *Asperula cynanchica.*
1. Flowering branch, natural size.
2. Floriferous apex of a branch.
3. Detached flower.
4. Corolla split open, showing the stamens in situ.
5. Anthers, back and front views.
6. Ovary.
7. —— cut vertically.
8. Ovary cut transversely.
9. Mature fruit.
10. —— cut transversely.
11. —— one-half detached.
12. —— cut vertically, showing the embryo.
13. Embryo detached.
14. Portion of the stem.
All more or less magnified.

IV. *Vaillantia muralis.*
1. Flowering plant, natural size.
2. A joint of the stem with the leaves and flowers in situ.
3. Fascicle of flowers, spread out to show the two exterior male ones and centre fertile one.
4. A detached male flower.
5. Stamens, back and front.
6. A mature seed.
7. The same cut transversely.
3. Detached embryo.

My solitary specimen of this plant being rather old, the analysis is less perfect than I could have wished.

LXXXV.—VALERIANEÆ.

This is a small order of herbaceous plants, sometimes with perennial roots, more rarely suffruticose or twining. The distinguishing peculiarities of the family are, its having fewer stamens than lobes to the corolla, a usually 3-celled, cohering ovary with two of the cells empty, or occasionally wanting, the third fertile with a single pendulous ovule, the seed exalbumenous with the radicle of the embryo superior. As regards Indian Botany or more properly in its relation to the flora of the Indian Peninsula, this family is of secondary importance. Only 4 species having yet been discovered in Southern India and all these confined to the highest mountains. All four are indigenous on the Neilgherries, one is found on the Pulney mountains, and one in Ceylon.

Character of the Order. Calyx with a limb of various kinds, either membranous or resembling a pappus. Corolla inserted into the top of the ovarium, tubular, usually 5-lobed, rarely 3–4-lobed, lobes obtuse: tube equal, or gibbous, or spurred, at the base. Stamens 1–5, inserted into the tube of the corolla, and alternate with its lobes: anthers ovate, 2-celled. Ovarium cohering with the tube of the calyx (inferior), 1–3-celled: ovule solitary, pendulous: style filiform: stigmas 1–3, distinct or combined. Fruit dry, indehiscent, crowned with the limb of the calyx, 1-celled, or 3-celled (2 cells being then abortive). Seed solitary, pendulous. Albumen none. Embryo straight: radicle superior: cotyledons flat.—Leaves opposite, exstipulate.

Affinities. The nearest relations of this family are *Dipsaceæ* and *Compositæ*. From the former they are distinguished by their diffuse cymose not capitate inflorescence, the absence of an involucre, the 3-celled completely adherent ovary and exalbumenous seed: from the latter by their free anthers and pendulous not erect ovules. They are also related to *Caprifoliaceæ* through *Viburnum* which has a similar ovary, cymose inflorescence, and opposite leaves; but in most other respects are amply distinct.

Geographical Distribution. This is essentially an extratropical order, the few found within the tropics being all remarkably alpine in their habits. As already mentioned only four have yet been discovered in the Indian Peninsula and these only on the highest hills. On the Himalayas and in Cashmere they are much more abundant, furnishing representatives

VALERIANA HOOKERIANA (W & A.)

of several genera natives of these mountains. They are also common in Europe but most abound in the extratropical portions of South America, especially on the range of mountains which bound the western coast of that continent, hence they are very abundant on the mountains of Chili. In North America and Africa they are very rare, and in Australia they have not yet been found.

Properties and Uses. The roots of several of the perennial species of Valerian especially *V. officinalis* have at different times been extolled on account of there aromatic and antispasmodic virtues, more particularly for the cure of some forms of Epilepsy and Hysteria. Like many other useful medicines they have fallen into considerable disrepute owing to being administered indiscriminately in all forms of those diseases, without reference to their origin, and, because they proved powerless in incurable forms, were soon pronounced inefficient in all. In this instance the degradation has not gone so far as this, as Tincture of Valerian is still prescribed in various forms of nervous diseases, and, upon the whole, its claims to this distinction seem well founded.

Its stimulating and aromatic properties have also led to its administration, in combination with Bark, for the cure of intermittent fever.

Viewing the first stage of the paroxysm of an intermittent fever as the very concentration of nervous disease in which almost every voluntary muscle of the body is more or less intensely subjected to spasmodic action, I should imagine this a very useful combination in situations where the more powerful quinine and morphia were not obtainable. But when these are to be had, I presume no judicious practitioner would load his patient's stomach with the bulky, nauseous, doses of the substance of these medicines which would be required to ward off the paroxysm of an ague. Chemistry has not, so far as I am aware, discovered whether the tonic and antispasmodic virtues of Valerian are concentrated, like those of Cinchona and Opium, in an alkaloid base. Should such prove to be the case, I apprehend that, in combination with quinine, it will prove a valuable addition to our materia medica, but if not, it is not probable the original will rise in the estimation of modern practitioners, though it has maintained its reputation, ever since the days of Dioscorides, who flourished during the first century of the present era.

The roots of other species are esteemed among Oriental nations for their fragrance, and are employed as cosmetics, and to perfume their baths. In the Levant *V. celtica* is largely consumed for these purposes, and the Nard or Spikenard of the ancients, a native of the Himalayas, has been celebrated from the most ancient times, for both its fragrance and medicinal virtues. The plant which produces this root long eluded the researches of the learned, but was at length traced by Sir William Jones to the Indian Jatamansi, after which the subsequent steps of the inquiry were comparatively easy, and were most satisfactorily followed up by Dr. Royle, who succeeded in purchasing a quantity of the root in a sufficiently fresh state to grow on being replanted. A figure of the plant, so obtained, he has published in his Illustrations of the Botany of the Himalaya Mountains, and thereby effectually set the question at rest. The plant forms the type of a distinct genus which has received the name of *Nardostachys*, the species retaining its Indian name. *N. Jatamansi*, of modern Botanists, is therefore the far-famed Spikenard of the ancients.

Remarks on Genera and Species. Under this head I have nothing to offer. My acquaintance with the Order being very limited, having had so few opportunities of making myself acquainted with its peculiarities.

EXPLANATION OF PLATE 129.

1. *Valeriana Hookeriana.* Natural size.
2. Fascicle of 2 flower-buds and bracts, one near expansion.
3. —— of 2 flowers, one full blown.
4. Corolla split open, showing the insertion of the stamens.
5. Anthers, back and front views.
6. Ovary before the evolution of the involute lobes of the calyx, with the style and stigma.
7. A nearly mature fruit, showing the papus-like calyx lobes fully evolved.
8. The same cut transversely, one-seeded.
9. Cut vertically, showing the solitary, pendulous seed.
10. Embryo detached.

LXXXVI.—DIPSACEÆ.

This, like the preceding, is a small order of extra-tropical plants, of which two only have yet been found in the tropical portion of India, one on the Neilgherries and one in Ceylon.

Thus limited in the number of its species, the family is principally interesting on account of an unusual peculiarity of structure, each floret being enclosed, in addition to the usual calyx, in an involucel resembling an outer calyx, which embraces the ovary and base of the calyx, and separates with it when the seed has attained maturity. The calyx is of that kind called superior or adherent, that is, the ovary is inclosed in its tube, which contracts at the neck and afterwards the limb expands, assuming various forms. The designation "superior calyx" originated in an idea, that the limb only formed the calyx, and that it sprung from the apex of the ovary. This doctrine is now exploded, and some of the species of this family supply conclusive proof of the propriety of so doing, as a longitudinal section of the ovary of those plants shows the tube of the calyx quite distinct from the ovary, all except the neck, where alone it adheres, presenting the ovary with its suspended ovule enclosed in a loose sack, the orifice only having contracted an adhesion with its contents.

Character of the Order. Calyx with a limb short or elongated, entire, or toothed, or pappose. Corolla inserted on the apex of the tube of the calyx, tubular; limb oblique, 4–5-lobed, rarely ringent: æstivation imbricated. Stamens 4, inserted on the tube of the corolla, alternate with its lobes, almost always distinct: anthers 2-celled. Ovarium cohering with the tube of the calyx, either closely, or only by the apex, or at first free and afterwards cohering, 1-celled: ovule solitary, pendulous: style filiform: stigma simple. Fruit dry, indehiscent, crowned by the limb of the calyx, usually covered by an outer calyx or involucellum, 1-celled. Seed solitary, pendulous. Embryo straight, in the axis of a fleshy albumen: radicle superior.—Leaves opposite, very rarely verticillate, variable in shape on the same plant. Flowers densely capitate, or very rarely verticillate.

Affinities. These are clearly with *Valerianeæ*, on the one side, and *Compositæ* on the other. From the former they are distinguished by their capitate iufloresence, albumenous seed, and involucel: from the former by their free anthers, albumenous seed, and pendulous ovule, generally the involucel is wanting in *Compositæ*, but it does occur, or something very similar, in *Lagascea*, a genus of Compositæ.

Geographical Distribution. Europe, Barbary, Asia Minor, the Cape of Good Hope are assigned as their principal localities. To these the Himalayas, Cashmere, and, as already stated, the Neilgherries and Ceylon, have now to be added. On the Neilgherries, *Dipsacus Leschenaultii* is very common, sometimes attaining the height of 4 or 5 feet.

Properties and Uses. These are sufficiently unimportant. The heads of the Teazel *(Dipsacus fulonum)*, are used in carding cloth. Its flowers are furnished with hard spiny bracts, and are found superior for that purpose to any artificial substitute yet invented. The roots of the Devil's Bit Scabious were formerly esteemed so valuable as a medicine that it is said the Devil in pure spite bit them off. He appears to have completely attained his object, as the part left is not now found to possess any of the sanatory virtues formerly attributed to the entire root.

EXPLANATION OF PLATE 130.

1. *Dipsacus Leschenaultii.* Small portion of a plant, natural size.
2. Detached flower, showing the involucral bract, the calyx-like involucellum, and exserted limb of the calyx.
3. Corolla split open, showing the tube hairy within, and insertion of the stamens.
4. Anthers, back and front views.
5. Ovary, the involucel and calyx split open.
6. A seed cut transversely.
7. A full-grown fruit crowned with the calyx.
8. The same cut vertically, showing the pendulous seed.

9.–10. Upper and under surfaces of the leaf.

All more or less magnified.

DIPSACUS LESCHENAULTII (COULT.)

LXXXVII.—ASTERACEÆ.

Compositæ—Synanthereæ.

This is by far the largest and also about the most natural of the whole series of natural orders of dicotyledonous plants. The elaboration and publication of the vast mass of material placed at the disposal of the late Professor DeCandolle, for the elucidation of this family, occupied that most eminent and indefatigable Botanist nearly eight years. The result of these labours has, as might be expected from his talents and assiduity, put the world in possession of the most masterly account of this gigantic order that has ever appeared. His monograph is said to include 8500 species, and though the last part was published so late as 1838, there has already been great additions made and more are daily being added, so that I presume 10,000 species may already be set down as the number known to belong to it. Many of these species are doubtless described twice over and some, perhaps, even oftener than that, under different names, but I dare say it will as often be found that two or three species are included under one, owing to several persons describing, in different places, distinct species under the same name, an event of frequent occurrence, but not easily detected except by a comparison of authentic specimens which are not always attainable.

It is an interesting fact in natural history that out of the immense mass of species congregated under a common denomination, and presenting among themselves almost every form of vegetation, yet so constant are the distinctive family characters by which they are bound together, that almost any one species being thoroughly known and these characters clearly understood, there is no difficulty in afterwards recognizing any other of the whole group as belonging to this family. These characters may be summed up in few words:—Flowers, or florets, as they are usually called, in heads, surrounded by an involucrum and seated on a common receptacle: an obsolate, chaffy, or pappus, calyx: monopetalous superior corolla: united anthers, forming a tube round the style: and a 1-celled ovary with a single erect ovule.

Numerous other peculiarities belong to the family as will be seen from a perusal of the following very extended descriptive, or natural, character which I introduce in full from DeCandolle's Prodromus, after the ordinary "character of the order," but the above comprehends the more obvious essential peculiarities of the order. Those, however, require to be taken together to constitute a true Compositous plant, for each taken separately is found in other families, but never the whole.

Character of the Order. Flowers (florets) unisexual or hermaphrodite, collected in dense heads upon a common receptacle, surrounded by an involucre. Bracts either present or absent; when present stationed at the base of the florets, and called paleæ of the receptacle. Calyx superior, closely adhering to the ovary, and undistinguishable from it; its limb either wanting or membranous, divided into bristles, paleæ, hairs, or feathers, and called pappus. Corolla monopetalous, superior, usually deciduous, either ligulate, or funnel-shaped; in the latter case 4- or 5-toothed, with a valvate æstivation. Stamens equal in number with the teeth of the corolla and alternate with them; the anthers cohering into a cylinder. Ovary inferior, 1-celled, with a single erect ovule; style simple; stigmas 2, either distinct or united. Fruit a small, indehiscent, dry pericarp, crowned with the limb of the calyx. Seed solitary, erect; embryo with a taper inferior radicle; albumen none.—Lindley.

Natural Character. Calyx tubular adhering to the ovary; tube sometimes only equalling the ovary *(fruit erostrate)*, sometimes prolonged beyond *(fruit rostrate)*, the limb or pappus sometimes wanting, or reduced to a mere margin; sometimes, but rarely foliaceous, sometimes scarcose; entire, dentate, lobed, or more frequently passing into chaffy scales or bristles, which are either simple, branched, denticulate or feathery; one, two

or several series. Corolla monopetalous, inserted on the top of the calyx tube, neurumphipetalous, that is, the petals are furnished on the margins with nerves, whence there usually appear only 5 nerves in the tube (two and two united), extending from the base to the divisions, and ten in the limb, one on each margin of each lobe; to these are sometimes added, but very rarely visible, accessory nerves occupying the middle of the petals. The length of the tube from the base to the point of apparent attachment of the filaments is various. The throat is often dilated from the insertion of the filaments to the lobes: the lobes are usually 5, more rarely 4, 3, or 2, valvate in æstivation; sometimes they are all equal, sometimes more or less unequal or irregular, or palmated, or two-lipped (the outer lip formed by the cohesion of 3 lobes, and the inner of 2; or the outer of 4 and the inner of 1, sometimes divided by a single fissure on the interior side, and then all are united into a single, flat, 5-toothed, strap-like petal. Stamens 5, rarely 4, wanting, or rudimentary, in female or sterile flowers: filaments alternate with the lobes of the corolla and therefore congruent with the nerves of the tube; attached to the tube of the corolla and free above; either altogether distinct or united into a tube (monadelphous), jointed near the apex, the upper joint antheriferous and occupying the place of a connective. Anthers erect, united into a tube round the style, *(Syngenesia* or *Synantherea)*, linear, 2-celled, opening within by a longitudinal slit, 4-valved; valves bent outwards (extroflexis) terminating in an appendix or wing, varying in different plants in the size and shape, often differing in consistence from the polleniferous portion: the base often lengthened into two tails, varying in length and shape. Pollen globose, or elliptic, echinulate or smooth. Ovary of one carpel, adhering to the calyx, with 1 ovule. Style terete or rarely thickened at the base (bulbosus), in male flowers, when present, often most simple; in female and hermaphrodite ones two-cleft; the branches (commonly called stigmas) flat above, convex below, sometimes altogether free, sometimes more or less united. Stigmatic glands, or true stigmas, in a double row, seated on the upper surface of the branches of the style, the rows continuous, marginal, roughish, more or less prominent or distinct. The upper parts of the style, of hermaphrodite flowers, furnished with rigid pollen-collecting hairs, seated either on the apex of the branches, or on their lower side; which are wanting in female or neuter flowers.

The fruit, or achænium, consists of the calyx tube, with the pericarp and seed coat more or less intimately united between themselves, and enclosing the embryo. The fruit is therefore 1-celled and 1-seeded, articulated with the receptacle, usually sessile, but sometimes stipitate, furnished at the base with a basilar or lateral areola; erostrate or beaked at the apex, surmounted by the pappus, terminated by an epigynous disk embracing a styliform or hollow central nectarium, continuous with the ovary. Seed erect, attached to the bottom of the fruit by a very short funiculus. Interior lamina of the seed coat Endopleura (albumen of Lessing), thickish, soft, diaphanous, perforated by the diaphanous funiculus. Embryo straight, radicle short, straight; cotyledons flat, often somewhat convex on the back, rarely curved, occasionally, by accident, three.

Inflorescence. Flowers collected into a *capitulus*, or *glomerulus* (the old compound flower). A Capitulum consists of a number of flowers, attached to a receptacle, or apex of a branch (a condensed spike), sometimes flat, sometimes conical, or elongated, the exterior or lower ones opening first. Flowers either all hermaphrodite, the capitulus is then *Homogamous;* or the exterior ones are female or neuter, the interior ones hermaphrodite, *Heterogamous;* or all, on the same plant, are either male or female, the capitula are then *Monoicous;* sometimes they are *Heterocephalous*, that is, in the same plant some are male some female; sometimes they are *Dioicous*, that is, the capitula of the plant are either all male or all female. Some capitula have all the flowers tubular, and are then *discoid* or *flosculose*, or they are all strap-shaped, and are then called *Ligulatæ* or *Semiflosculosæ*, or sometimes the flowers of the margin or ray are ligulate, and those of the centre or disk tubular, when they are called *radiate.* Sometimes all are bilabiate and are then *falsely-discoid* or *radiatiform. Discoid* and *falsely-discoid* capitula sometimes have the marginal flowers like, but larger than the centre ones, and are then said to be *crowned.*

The Involucrum, formerly called *common calyx*, consists of a number of leaves or

scales, forming either one or several series, free or united by the margins, dry, scariose, coriaceous, fleshy, prickly, or leafy: often furnished with an appendix. These series are either equal or unequal, imbricated or caliculate, or variously elongated.

A GLOMERULUS is a capitulum with one or few flowers, furnished with a proper involucrum, variously aggregated, enclosed in a general involucrum, seated on a general receptacle, the central ones flowering first, the exterior ones later or flowering out of the usual order.

The RECEPTACLE is either *paleaceous*, having a chaffy scale, similar to those of the involucrum, at the exterior side of each flower—these are articulated at the base, and sometimes, in a state of monstrosity, expand into true leaves; or *semipaleaceous*, the exterior circles of flowers only having them; or they are *epaleaceous* or naked. In some capitula the receptacle is said to be *fimbriliferous*, that is, each flower is embraced at the base by an irregular scaly margin; or *abveolate*, appearing as if honeycombed, not produced into bristles, but often denticulate; or, lastly, they are *areolate*, where a pentagonal areola surrounds the base of each flower.

VEGETATION. The plants of this family are usually herbaceous perennials, or shrubs; rarely trees; distributed all over the world, and constituting nearly one-tenth part of the vegetable kingdom. Leaves alternate or opposite, most various in their forms and divisions, but always simple, not compound. The stems (when simple), or the branches terminated by a capitulum or glomerules: the branches usually corymbose, the centre ones flowering first. The leaves under the capitula, differ from the others, and called floral or bractial, sometimes gradually passing into scales, or abruptly changed into much larger scales. Corolla sometimes yellow sometimes blue in the same capitulum; *Homochromous*, if all are of one colour, or *Heterochromous* if of different colours. When heterochromous the ray is always blue, the disk yellow, or the disk also becomes blue when, by monstrosity, the disk florets become ligulate. The proper *Juices* are various, sometimes milky. Taste usually bitter, astringent, or aromatic. D. C. Prod.

AFFINITIES. Under this head I know not what to say. Viewed as a whole, the limits of the order are so strictly defined that it may justly be said to stand alone in the midst of the vegetable kingdom, like a large island in the midst of the ocean, with a few smaller ones in the neighbourhood, but still quite distinct from all. Affinities, more or less close, it certainly has, but none, so far as I am aware, with which it can be confounded, the only genus referred to it, which does not at first sight proclaim itself a member of the family, being *Xanthium*, and it differs so widely in general appearance and even in some points of structure, that I cannot help wondering at its being permitted to retain its place.

Many plants have capitate inflorescence, and some have their florets bound by an involucrum, seated on a receptacle, and with even a pappus calyx, as, for example, *Dipsaceæ*, but they want the venation of the corolla, the valvate æstivation, the usually cohering anthers, and erect ovules of Compositæ. Some, as *Lobeliaceæ*, have cohering anthers, but differ in almost every thing else. Many have valvate æstivation, but none have it combined with the peculiar venation and united anthers of this family. Solitary erect ovules are also met with, but uncombined with any other of the essential characters of the order. Thus we see that more remote affinities abound, but really near relations still require to be sought for.

In explanation of the very important doctrine embodied in DeCandolle's term *Corolla Neuramphipetala*, I shall here introduce an extract from Mr. Brown's admirable paper on Compositæ, published in the 12th Vol. of the Linnæan Transactions, which details the facts on which it rests.

"The whole of Compositæ agree in two remarkable points of structure of their corolla; which, taken together at least, materially assist in determining the limits of the class. The first of these is its valvular æstivation; this, however, it has in common with several other families. The second I believe to be peculiar to the class, and hitherto unnoticed. It consists in the disposition of its fasciculi of vessels or nerves; these,

which at their origin are generally equal in number to the divisions of the corolla, instead of being placed opposite to these divisions, and passing through their axes as in other plants, alternate with them; each of the vessels at the top of the tube dividing into two equal branches, running parallel to and near the margins of the corresponding lacineæ, within whose apices they unite. These, as they exist in the whole class, and are in a great part of it the only vessels observable, may be called primary. In several genera, however, other vessels occur, alternating with the primary, and occupying the axes of the lacineæ; in some cases these secondary vessels being most distinctly visible in the lacineæ, and becoming gradually fainter as they descend the tube, might be regarded as recurrent; originating from the united apices of the primary branches; but in other cases, where they are equally distinct at the base of the tube, this supposition cannot be admitted. A monopetalous corolla, not splitting at the base, is necessarily connected with this structure, which seems also peculiarly well adapted to the dense inflorescence of Compositæ; the vessels of the corolla and stamina being united and so disposed as to be least liable to suffer by pressure."

Geographical Distribution. Representatives of this family are found in all parts of the world from the polar circles to the equator, and, according to DeCandolle, its species amount to nearly one-tenth of the Vegetable Kingdom. But, though thus generally distributed and, as a whole, form so large a proportion of the vegetation which covers the globe's surface, they are far from being equally prevalent, in proportion to the indigenous vegetation in different countries. According to Humboldt, every 7th flowering plant of France is a Composita; in Germany, every 8th; in Lapland, every 15th; in North America, every 6th; in tropical America, every 3d; of the North of New Holland, according to Brown, every 16th; and of a small collection formed on the banks of the Congo in Africa, every 23d. In Sicily, every 3d, the same in the Balearic Islands, while in Melville Island the proportion is nearly the same as in the tropical parts of New Holland, or about $\frac{1}{16}$. In India, taking Wallich's List as the standard, they occur in the proportion of $\frac{1}{22}$. These examples, which may be viewed as approximations to the truth, serve to show, with sufficient precision, the inequality of their distribution as well as the want of any fixed ratio of increase and decrease corresponding with latitude. On this subject, however, it is well remarked by Lindley, much still remains to be learned, and as I am myself only acquainted with the small fragment of the order appertaining to the Indian Peninsula, I am not in a position to throw light on its obscurities. I may however remark, that the number of alpine species of our flora is greater in proportion to the rest of the vegetation than on the plains. The number found above 3000 feet of elevation amounting to probably about 150 species, which I imagine is nearly in the ratio of 1 in 15 or 16 of the flowering plants of these regions.

DeCandolle gives the following summary as the result of his examination of the natural habit of Compositæ. "Out of 8523, of which he had any knowledge, 1229 were annuals, 243 biennials, 2491 perennials, 2264 under shrubs from 1 to 3 feet high, 366 shrubs from 4 to 15 feet high, 72 small trees, 4 large trees above 25 feet high, 81 woody plants of which nothing further was known [I have seen the Neilgherry *Monosis*, ranked in this division, fully 40 or 50 feet high, R. W.], 126 twiners or climbers, and 1201 about which nothing certain could be ascertained. These were distributed as follows:—347 in the South Sea Islands, 2224 in Africa, 1827 in Asia, 1042 in Europe, and 3590 in America. Of these the Cape of Good Hope possessed 1540, Mexico 725, Brazil 722, United States and Canada 678, the Levant 610, the Continent of India 681, North and Middle Europe 447, Europe at the Mediterranean 595, Australia 294." Lindley, extracted from D. C.'s Collection of Memoirs, No. X.

The following note, from M. Laseque's Musee Botanique de Delessert, regarding the proportion this family bears to the rest of the vegetable kingdom, is interesting. After stating that the order at the present day includes more species than was known altogether to Linnæus, he adds in a note: "It is a singular fact, that the proportion Compositæ bear to the whole of the known vegetable kingdom, has always been about the same,

that is to say, about one-tenth. Linnæus defined 785 out of 8500; in 1809 we reckoned 2800 Compositæ out of 27,000 species; DeCandolle, in 1838, described 8525, again about the tenth of the vegetable kingdom; and now, when the estimate has reached 95,000 species, we find the Compositæ amount to 9500.

Properties and Uses. These, when viewed in relation to the magnitude of the family, disappoint our expectations, and may be stated generally as being comparatively of inferior importance, while, as regards the Indian Flora, they are of very secondary note. Some are used as esculents, several are used in the arts, and a good many have attained some repute in medicine, but not one of the latter category even remotely approach, in their properties, the valuable qualities of the Cinchonas and many others met with in most other large families; and I believe I am correct in stating that, out of the whole 10,000 species included within the limits of this order, there is not one in current use in medical practice, for which substitutes generally equal to, or better than the original, cannot be readily obtained.

I shall however glance at a few of the principal articles appertaining to each of these heads. To treat the subject methodically, the proper plan would be to consider them under the leading Botanical divisions or sub-orders, but I apprehend the other will be esteemed the more convenient, as demanding from the reader a smaller amount of Botanical knowledge.

Esculents. Under this head we find several used as salads, substitutes for Spinach, and a few esculent roots. Among the first is the well known and justly appreciated Lettuce, *Lactuca sativea*, and Endive, *Cichorium Endiviva*, and *Intybus;* also the young and tender leaves of Swine's thistle, *Sonchus oleraceus*, and *Pieridium sativum.* The young leaves of Swine's thistle, boiled, are also esteemed a good substitute for Spinach; so are those of *Spilanthes oleracea*, an Indian plant of easy cultivation, but the good qualities of which we have not yet learned to appreciate. The Artichoke and Cardoon, *Cinera scolemus* and *Cardunculus*, are both well known, the former prized for its flower-heads before expansion—the fleshy bases of its involucre leaves and receptacle being the part used, the latter for the delicate, aspargus-like foot stalks of its leaves, when nicely blanched.

Among those cultivated for their roots, the Salsafy, *Tragopogon porrifolius*, merits prominent notice; their flavour is peculiar, but I believe, to most tastes, very agreeable. *Scorzonera deliciosa* is another of the same kind; they are cultivated like carrots or parsnips. Those of the Jerusalem Artichoke, *Helianthus tuberosus*, a species of Sun-flower, is also in repute, and has the advantage of being easily cultivated on the plains of India, which the others have not. On the Continent of Europe the Succory and Endive are largely cultivated for their roots, which are taken up in autumn, dried, roasted and powdered like coffee, for which they are sometimes used as a substitute, but oftener to adulterate that favourite beverage. Some persons even go so far as to assert that French coffee owes its superior flavour to that admixture.

Arts. Those used in the arts are not numerous. The seeds of several yield a bland oil, those for example of the Sun-flower, *Madia sativa*, and in this country the Ramtil, *Guezotia oleifera*, is in Mysore largely cultivated as an oil plant. In Chili and in Europe, the Madia is cultivated for the same purpose, and yields, as compared with Linseed, in the proportion of 32 to 21, while its cake is good feeding for cattle. It seems therefore a desirable plant for India. The petals of *Carthamus tinctorius*, yield a deep-yellow dye, much used in China for dying silk, and is cultivated in India for them, but I believe the seed are also pressed for oil. When used as a dye, the petals are infused in an alkaline solution, and afterwards treated with a vegetable acid. They are also prepared and used as a substitute for Saffron. The Polish Jews are said to be so fond of that preparation that they mix it with their bread and most other viands, and in England the lower orders mix it with their puddings. The corolla of the Dahlia furnishes a beautiful carmine, and *Eclipla erecta*, an Indian plant, found also in Brazil, stains black the hair of the Brazilian women.

As ornamental plants many are cultivated, but the Dahlia is the favourite in England. In India the French Marigold is in great repute among Mussulmen, and in European gardens the Coriopsis and Zinnea are frequent inmates, along with a few others. The *Chrysanthemum Indicum*, or Christmas flower, is much less known in India than in England.

Medicines. Under this head a long article might be written as many species are reputed to possess properties of considerable value, and doubtless many merit the reputation they have acquired, though now principally employed in domestic practice. It is not, however, my intention to dilate on this branch of the subject, in a work appropriated to Indian Botany, so few of those favourably spoken of being natives of this country or even procurable in it. As a general principle it may be remarked that many of those used in medicine are distinguished for their possession of bitter and aromatic properties, and are therefore adapted to the treatment of diseases of debility. Of this description are our *Artimesia Indica* and *Vernonia Anthelmentica*, the leaves and tops of the former, in form of infusion and electuary, being prescribed by native practitioners in various forms of nervous and spasmodic diseases connected with debility and obstructed secretions, and as an antiseptic fomentation in foul spreading ulcers; while the seeds of the latter, which are bitter and pungent, are, as the name imports, valued as a remedy against worms. On the Malabar Coast it is stated an infusion of them is given for coughs and in flatulencies. *Wedelia* (or Verbesina) *calendulacea* (R. W. Icones, No. 1109), is "pleasant and somewhat aromatic to the taste" and every part of it is used in medicine. It is prescribed in powder and decoction in jaundice and visceral obstructions. The root of *Anacyclus* (Anthemis) *Pyrethrum*, to be met with in most Indian bazars, is acrid and pungent, causing, when chewed, a copious flow of saliva, hence is useful in toothache through its depletory action and counter irritation. The effect is attributed to a soft resin and ætherial oil which enter into its composition. With these I believe I have nearly gone through the list of Composite plants used in native practice in Southern India. With the exception of the last, not an Indian plant, I am not aware of any of them being prescribed by European practitioners, but some of them seem to merit a trial. But it would be doing injustice to the subject were I to stop here. The milky juice of several species of Lettuce, when inspissated by exposure to the sun, becomes the well known, but not now much used, Lactucarium, a narcotic of some power, free from the stimulating properties of opium, for which it is occasionally substituted in cases where that drug is inadmissible. On the Continent of Europe the roots of the Endive are in great repute in domestic practice, but I presume are not very active in their operation, otherwise they would not be so much used as aliments. The Thistle tribe, *Cynareæ* or *Carduaceæ*, are bitter and stimulant, and some are endowed with diuretic and diaphoretic virtues. The seed of many of them are oily and purgative but destitute of aroma. The seed and leaves of the Blessed thistle, *Cnicus benedictus*, were formerly in high repute as tonics in Europe, and many species of *Centauria*, *Carduus* and *Cnicus* are still in use on the Continent as tonics and febrifuges, but are nearly wanting in the Flora of India. *Eupatorium Ayapana* is, both in China and India, supposed to be an antidote to snake bites, and doubtless is as efficient as a hundred other equally impotent remedies that have obtained similar repute, the cures being for the most part referable to the *post hoc* not *propter hoc* principle. An infusion of the leaves is however said to form an excellent diet drink, and their juice to be very effective in cleaning foul ulcers. *Grangea Madraspatana*, a common Indian plant belonging to the Asteroid division of the order, but referred by Linnæus to Artimesia, may be noticed as another medicinal plant, though not mentioned by Ainslie. *Artimesia chinensis* yields the celebrated moxa. *Myriogyne minuta* (*Artimesia sternutatoria*, Roxb.), and *Arnica montana* are both violent sternutatories, and the latter, known in England under the name of "mountain tobacco," is said to be a virulent plant, acting as an acrid narcotic agent. It is recommended in putrid fevers, and in paralytic affections is considered so efficacious that it has, in Europe, got the name of Panacea lapsorum. Many more might be mentioned but I must refer those desirous of further information to Lindley's Vegetable Kingdom and Endlicher's Enchridion Botanicum.

Remarks on Genera and Species. In so extensive an order, and one to the knowledge of which the Indian Botanist has no guide more compendious than a general system of Botany,

in which he must search through upwards of 1000 genera to find the genus of any species he may have under examination, I have thought I might render him a more acceptable service by preparing a brief Synopsis of all those appertaining to the Indian Flora, than by any amount of remarks on such of them as may have engaged my particular attention. Such a synopsis, if but moderately well drawn up, should materially lessen his labour, while endeavouring to ascertain the genus of an unknown plant, through the simple operation of concentrating his attention on about one-tenth of the whole number embraced by a general system of Botany, exclusive of the advantage of having only to deal with the most essential points of the character of each genus.

The characters as given in the following Synopsis are simply abreviations, of those of DeCandolle's Prodromus, and therefore can only be viewed as aids to the knowledge of, not as substitutes for the originals, the difference between the two being that mine are somewhat differently arranged and include only the essential particulars of his fuller definitions. I was in the first instance induced to undertake this abridgment from having myself often felt the want of some work to which I could refer for Indian genera, apart from those of the rest of the world (still a desideratum), while undergoing the irksome labour of studying the characters of numerous foreign ones, where there was no chance of finding what I wanted, and now publish it in the hope of thereby smoothing down, for others, some of the impediments which then beset my own path. If I have succeeded in lightening the labours of those following in the same track mine is amply rewarded. A compendium of all the Indian species described in that great work would prove a boon indeed to the Indian Botanist, and it is to be hoped that this consideration will induce some one, having leisure for the task, to undertake the work, as the materials accumulated by the esteemed author, though still imperfect, are wonderfully complete.

Various plans for the subdivision and grouping of the species of this great family, to bring them more within our grasp, have at different times been proposed. Tournefourt divided Compositæ into three Classes, adopting as the basis of his arrangement the form of the corolla: *Flosculose*, *Semiflosculose* and *Radiate*. The first of these included the modern *Cynareæ*, to the second *Cichoraceæ* corresponds, and to the last all those with *Radiate* flowers.

Jussieu also divides them into three Classes or Orders: *Cichoraceæ*, *Cinocephalæ* and *Corymbiferæ*. The first is still retained, and also, with some modifications, the second: the third, having capitula, partly flosculose partly ligulate, or altogether flosculose, but with male or hermaphrodite flowers in the centre and females in the circumference (DeCandolle's Tubulifloræ), has been largely modified by late observers.

Linnæus divides his 19th Class, Syngenesia, into five orders. 1st. *Polygamia eqaulis*, flowers all perfect. 2d. *Polygamia superflua*, flowers of the disk hermaphrodite, of the ray female. 3d. *Polygamia frustrania*, flowers of the disk hermaphrodite, of the ray sterile. 4th. *Polygamia necessaria*, flowers of the disk male, of the ray female; and 5th. *Polygamia segregata*, the general capitulum made up of a series of minor capitula, each containing from one to several flowers, having the united anthers of the class.

Cassini divided the Order into 19 Tribes, each mainly resting on some peculiarity of the style and stigma. Lessing adopted the principles of his arrangement to a certain extent, but reduced the number of tribes from 19 to eight, taking the primary characters of his tribes from the style of the stameniferous flowers.

DeCandolle has adopted Lessing's eight Tribes as the basis of his arrangement, but has recast the distribution, by combining them with other characters taken from the inflorescence, hence his three primary groups: *Tubulifloræ*, *Labiatifloræ* and *Liguliflorœ*, a division, perhaps somewhat artificial, but certainly calculated most materially to lighten the labour of ascertaining the name and place of an unknown genus. The tribes are distinguished by certain peculiarities of the style.

These styloid distinctions are not always, especially in the first division, of easy application in practice, but, notwithstanding the, apparent, narrowness of the foundation, it seems to have afforded room enough for the erection of a large and wonderfully perfect edifice. It is probable it is but another step towards a better by throwing much new light on many parts previously most obscure and unintelligible.

SYNOPSIS OF THE GENERA OF INDIAN COMPOSITÆ, TRANSLATED AND ABRIDGED FROM DE CANDOLLE'S PRODROMUS—WITH A FEW ADDITIONS AND OCCASIONAL NOTES.

INTRODUCTION.

It will be seen by those who take the trouble to compare the following characters with the originals, that I have generally departed considerably from De Candolle's arrangement. My object in doing so was to render them more compendious, the alteration in form better enabling me to retrench superfluities, and at the same time give greater precision, by placing the strongest points of each at the beginning. The characters taken from the capitula, flowers, achænia, and pappus—which are really the essential ones—occupy the first rank: while those taken from the vegetation generally, including the texture and duration of the stem, form, and position of the leaves, peculiarities of the inflorescence, the receptacle and its clothing, and the colour of the flowers, are uniformly referred to the second. By following this plan, the characters are in fact completely recast, and, though still made up of the original materials, are, I think, rendered of much more easy application in practice, and to that extent at least are improved.

According to De Candolle's classification, the whole family is divided into three primary groups or sub-orders, viz. *Tubulifloræ*, *Labiatifloræ*, and *Ligulifloræ*.

These are again divided into "eight tribes," each of which is still further divided into "sub-tribes," "divisions" and "sub-divisions."

Of all these analytical divisions I have availed myself in the construction of this Synopsis, not that I considered the introduction of such elaborate machinery necessary for the working out of the few genera I have to deal with, but as furnishing an instructive example of skilful and lucid analysis, successfully brought to bear on the discrimination of individuals, among a vast assemblage of natural objects, all so intimately blended with each other that, without some such contrivance to aid the apprehension and memory, they never could be brought within the grasp of human comprehension.

* TUBULIFLORÆ. Hermaphrodite flowers tubular, regular, 5- (rarely 4-) toothed. [In this division all sorts of flowers occur, hermaphrodite, female and male, possibly sometimes all in the same capitulum—two kinds very generally, female and hermaphrodite—the character is however limited to the hermaphrodite flowers.]

Tribe 1st. VERNONIACEÆ. Style of the hermaphrodite flowers cylindrical; branches usually elongated, subulate, rarely short and obtuse, always equally and longish hispid (semper equaliter et longiuscule hispidis); stigmatic series ending above the middle of the branches of the style. [Of this tribe D. C. defines 59 genera, 7 of which have Indian representatives.]

Tribe 2d. EUPATORIACEÆ. Style of the hermaphrodite flowers cylindrical; branches long, somewhat thickened or clavate above, exteriorly puberulously papillose; stigmatic series scarcely elevated, usually ending above the middle of the branches of the style. [Genera 44, of which 5 only are found in India.]

Tribe 3d. ASTEROIDEÆ. Style of the hermaphrodite flowers cylindrical; branches exteriorly somewhat flattened, equally and minutely puberulous above; stigmatic series prominent, extending almost to the origin of the exterior hairs. [To this tribe 172 genera belong, 38 of which have Indian species.]

Tribe 4th. SENECIONIDEÆ. Style of the hermaphrodite flowers cylindrical; branches linear penicillate at the apex, sometimes produced beyond the penicillus into a short cone, or elongated into a narrow hispid appendix; stigmatic series broadish and prominent, extending to the pencil. [This is by much the largest tribe of the family: it contains 388 genera, 42 of which have Indian representatives.]

Tribe 5th. CYNAREÆ. Style of the hermaphrodite flowers nodosely thickened above, often penicillate at the knot; branches sometimes cohering, sometimes free, puberulous exteriorly; stigmatic series not prominent, confluent, extending to the apices of the branches and there confluent. [To this tribe 81 genera are referred, 18 of which have Indian representatives.]

** LABIATIFLORÆ. Hermaphrodite flowers, usually bilabiate.

Tribe 6th. MUTISIACEÆ. Style of the hermaphrodite flowers cylindrical, or somewhat nodose above; branches usually obtuse or truncated, very convex, and clothed on the superior part with minute hairs, which are rarely wanting. [This tribe includes 54 genera, only 6 of which are referable to the Indian Flora.]

Tribe 7th. NASSAUVIACEÆ. Style of the hermaphrodite flowers not nodosely thickened; branches linear longish, truncated at the apex or penicillate. [This tribe contains 26 genera, but has no Indian representative.]

*** LIGULIFLORÆ. All the flowers hermaphrodite.

Tribe 8th. CICHORACEÆ. Style cylindrical above; branches longish, somewhat obtuse, equally pubescently-roughish; stigmatic series ending above the middle of the branches of the style. [This last includes 83 genera, of which 16 have Indian species.]

The total number of genera is extracted from Meisner's "Genera Plantarum," as, owing to some errors in the numbering of the series in D. C.'s Prodromus, they could not be so correctly obtained from that work. A few genera were omitted by D. C. which, when added to the above, make up the total number to about 920. Several have however been since added to that series, so that the total number now defined in Botanical works may perhaps amount to about 950. Some of these will probably require to be reduced, but others must be formed to include imperfectly known species, which are, for the present, referred to genera to which they seem most nearly related, but to which they may not properly belong, as for example *Oligolipes*, in this list.

P. S. Oct. 1848. According to Lindley's Veg. Kingdom, published last year, but the preface dated October 1845, there were then 1005. If his list was completed three years ago, it is probable the list of genera at

the present time amounts to 1050. According to this estimate the Indian portion of the Order has representatives of about one-eighth of the whole number of genera, but only about one-fourteenth or one-fifteenth of the species.

SYNOPSIS OF THE GENERA OF INDIAN COMPOSITÆ.

TUBULIFLORÆ.

Tribe I. Vernoniaceæ.

Sub-tribe. Vernonieæ. *Capitula discoid homogamous. Branches of the style elongated or acuminate.*

Div. I. Euvernonieæ. *Anthers ecaudate, involucre not compressed, polyphyllous.*

* *Pappus none, or simple, crown-like.*

1. Oiospermum (Less. D. C. Prod. 5–11). Capitula many-flowered, flowers equal. Achænia rounded at the apex, 10-ribbed. Pappus wanting.—Herbaceous, diffuse, opposite-leaved plants. Capitula solitary, long peduncled, opposite the leaves. Involucre spreading, terete, surrounded at the base by unequal-sized leaves, longer than the capitulum. Receptacle naked, broad. Corolla regular, 5-cleft, pale. Peninsula, one species, station unknown.

2. Ethulia (Cass. D. C. 5–12). Capitula many-flowered. Achænia obpyramidal, 4-sided, 4-ribbed, glabrous, glandular, truncated at the apex. Pappus minute, entire, fleshy, crown-like.—Erect, ramous herbs; leaves alternate, pellucid, dotted. Involucre terete, many series, scales sub-foliaceous. Receptacle naked. Corolla rosecoloured or purple. Bengal, one species.

** *Pappus 1, or several series; interior ones always bristle-like.*

3. Vernonia (Schreb. D. C. 5–15, R. W. Icon. 829 and 1076 to 79). Capitula usually many-flowered. Achænia with a cartilaginous callous at the base, and a large epigynous disk. Pappus usually a double series, the interior one bristly, much longer than the paleaceous outer one.—Herbs, shrubs or trees; leaves alternate, often glandulose. Involucre imbricated, interior squamæ longest. Receptacle naked, or rarely sub-fimbrillose. Flowers few or many. Corolla regular, 5-cleft, usually purple or rose-coloured. Generally diffused over India.

4. Decaneurum (D. C. 5–66, R. W. Icon. 1080 to 84). Capitula many-flowered. Achænia usually glabrous, marked with 10 prominent ribs. Pappus 1 series, bristles thick, rigid, densely barbellate.—Herbaceous or suffruticose; leaves alternate. Involucre imbricated, often surrounded with foliaceous bracts. Receptacle flat, alveolate. Flowers regular, 5-cleft, purplish. Widely diffused, preferring alpine ranges.

5. Cyanopis (Bl. D. C. 5–69). Capitula many-flowered, homogamous. Achænia prismatico-pentagonal, glabrous, the terminal areola broad sub-capitulate. Pappus 1 series; bristles rigid, distinct to the base, deciduous, rough.—Erect, ramous herbs, probably annuals; leaves alternate. Capitula few on the points of the branches. Involucre hemispherical, scales many series, imbricating. Flowers bluish. Java, Burma, Moluccas.

6. Monosis (D. C. 5–77, R. W. Icon. 1085). Capitula 1-flowered. Achænia glabrous, terete. Pappus 2–3 series, bristles rigid, scabrous.—Arboreous or suffruticose, leaves alternate. Panicles naked, the apices of the branchlets bearing numerous sub-umbellate, sessile capitulæ. Scales of the involucre imbricated, obtuse, shorter than the flowers. Corolla rose-coloured. [M. Wightiana is a considerable tree, with large obovate leaves, traversed by thick transverse veins, like those of a Dillenia.] Eastern slopes, Neilgherries.

Div. II. Elephantopeæ. *Anthers ecaudate. Involucre compressed; scales alternately conduplicate.*

7. Elephantopus (Cass. Lin. D. C. 5–85, R. W. Icon. 1086). Capitula of several (3–5, usually 4) equal flowers, densely congested into a glomerulous, enclosed by leaves. Achænia slightly compressed, many-ribbed, pilose. Pappus 1 series, some of the bristles dilated at the base.—Perennial, erect, pilose herbs with alternate, sessile leaves and terminal glomerulus. Involucre compressed, scales in a double series, alternately flat and conduplicate. Rachis naked. Corolla palmate, limb 5-cleft, one of the fissures deeper. Generally diffused.

Tribe II. Eupatoriaceæ.

Sub-tribe. Eupatorieæ. *Capitula homogamous.* Flowers never, strictly speaking, yellow.

* Agerateæ. *Pappus paleaceous or partly squamellate.*

8. Ageratum (Lin. D. C. 5–108). Capitula many-flowered. Achænia somewhat 5-angled, attenuated at the base. Pappus 5–10, free paleaceous scales, aristato-acuminate, or pectinate obtuse.—Annual, erect herbs, with opposite leaves. Involucre imbricated. Receptacle naked. Flowers blue or white. A common weed every where.

9. Adenostemma (Forst. D. C. 5–110, R. W. Icon. 1087–88). Capitula many-flowered. Achænia obovate oblong, surmounted by 3–5 rigid bristles, glandular, globose or clavate at the apex.—Herbs with opposite leaves and corymbosely panicled capitula. Involucre campanulate, somewhat shorter than the flowers. Squamæ 1 series, foliaceous, oblong. Receptacle flat, naked, foviolate. Corolla white. Stigmas long exserted, thickened at the point and coloured. Alpine plants, widely distributed over India.

** *Pappus selose, barbellate or plumose.*

10. Eupatorium (Tourn. D. C. Prod. 5–141). Capitula many-flowered. Achænia angled or striated. Pappus 1 series, pilose, rough.—Herbs or under-shrubs. Leaves usually opposite. Capitula corymbose or panicled. Scales of the involucre 1 to several series imbricating. Receptacle flat, naked. Corolla dilated at the throat, purple, blue, or white. Branches of the style exserted, obtuse. Nepaul, Khassya mountains, &c.

11. Mikania (Willd. D. C. Prod. 5–187). Capitula 4-flowered. Achænia angled. Pappus 1 series, pilose

roughish.—Shrubs or herbs often climbing. Leaves opposite often united between themselves by a transverse projection. Capitula spicate, racemose, corymbose, or panicled. Involucre 4-leaved, with bracts at or below the base. Tube of the corolla short, dilated, campanulate at the throat, white or pale yellow. Anthers subexserted. Penang and Eastern Islands generally.

Sub-tribe. Tussilageneæ. *Capitula heterogamous or dioicous.*

* *Capitula radiate. Ray florets ligulate female, disk ones tubular male.*

12. Tussilago (Tourn. D. C. Prod. 5–208). Capitula many-flowered, heterogamous. Ray several series, narrow ligulate, female; flowers of the disk few, tubular, male; limb campanulate, 5-toothed. Achænia of the ray oblong, cylindrical, glabrous, of the disk, abortive.—Perennial herbs. Leaves produced after flowering. Scape scaly, 1-cephalous. Involucre 1 series. Flowers yellow. Himalayas.

Tribe III. Asteroideæ.

Sub-tribe I. Asterineæ. *Capitula homo or heterogamous usually radiate. Anthers ecaudate, leaves almost always alternate.*

Div. II. Astereæ. *Capitula heterogamous, radiate. Receptacle epaleaceous, naked, alveolate, or fimbriliferous.*

* *Achænia compressed. Pappus pilose, one or several series.*

13. Aster (Nees. D. C. Prod. 5–226). Capitula radiate, flowers of the ray 1 series, fertile; of the disk hermaphrodite, 5-toothed. Achænia compressed. Pappus pilose, persistent, several series: bristles scabrous, unequal, otherwise similar.—Perennial herbs, with alternate leaves. Capitula solitary or several, corymbose. Scales of the involucre several series, loosely imbricated. Receptacle alveolate; margins of the alveolæ more or less dentate. Florets of the ray white, blue, or purplish; of the disk yellow. [This genus seems scarcely admissible into the Indian Flora.]

14. Galatella (Cass. D. C. Prod. 5–254). Capitula radiate, ray 1 series, ligulate, neuter or with abortive female organs, disk hermaphrodite, fertile. Achænia densely hairy or strigose. Pappus several series, bristles rigid, rough.—Perennial herbs with simple stems, corymbose at the apex. Leaves alternate, 3-nerved at the base, punctuate. Involucre scales shorter than the disk, imbricated. Receptacle alveolate. Alveolæ toothed. Branches of the fertile styles spathulate. Disk yellow, ray blue, purple or white. Himalayas.

15. Calimeris (Nees. D. C. 5–258). Capitula radiate, ray ligulate female, 1 series; disk hermaphrodite, fertile. Achænia compressed, rough on the margin. Pappus about 1 series, rough, unequal.—Herbaceous perennials, stems angled, corymbose. Scales of the involucre 2–4 series, herbaceous, loosely imbricated. Receptacle alveolate, alveolæ 4-angled, angles toothed. Florets of the ray white or blue, of the disk yellow. Himalayas, Massurie.

** *Pappus double, exterior series squamose, interior pilose.*

16. Callistephus, (Cass. D. C. 5–274, R. W. Icon. 1085). Capitula many-flowered; of the ray ligulate, female; of the disk tubular, hermaphrodite. Achænia obovate, cuniform, compressed, roughish. Pappus double, each of 1 series; exterior short, paleaceously setaceous, cohering into a crown; interior long, filiform, rough, deciduous.—Erect, ramous, herbaceous annuals; branches with a single capitulum on the apex. Involucre 3–4 series. Scales ciliate, obtuse, embraced by foliaceous bracts, shorter than the involucre. Receptacle slightly alveolate. Flowers yellow. Frequent in the Southern provinces in cultivated lands.

17. Diplopappus (Cass. D. C. Prod. 5–275). Capitula many-flowered radiate; florets of the ray 1 series, ligulate, female; of the disk hermaphrodite, 5-toothed. Achænia oblong, compressed. Pappus of the disk and ray double, roughish, exterior short, setulose, interior long, bristly.—Herbs or under shrubs. Involucre scales imbricate. Receptacle flat, sub-foviolate. Ray white, blue or purple, disk yellow. Nepaul, Kemaon.

*** *Florets of the ray several series, pappus pilose, 1–2 or several series; exterior one equal or a little shorter.*

18. Fullertonia (D. C. Prod. 5–281). Capitula many-flowered heterogamous; ray several series, narrow ligulate, female; disk hermaphrodite, 5-toothed. Achænia beakless terete, of the ray bald, of the disk crowned with reddish pappus.—Herbs, leaves alternate semi-amplexicaule. Capitula solitary on the ends of the branches and in their axils. Involucre polyphyllous, 1–2 series, embraced by foliaceous bracts. Receptacle naked. Flowers, from dried specimens, appear to be white or pale yellow. Kemaon.

19. Heterochœta (D. C. 5–282). Capitula many-flowered radiate; ligulæ female, linear, several series; disk hermaphrodite. Young achænia compressed? Pappus double, exterior short, paleaceous, interior long bristly, rough.—Pilosely villous, whitish herbs. Capitula solitary, terminal. Scales of the involucre 2–3 series, equal, acuminate. Receptacle naked, punctulate. Flowers of the ray white or purplish. Himalayas.

20. Erigeron (Lin. D. C. 5–283, R. W. Icon. 1090). Capitula many-flowered radiate; ligulæ linear, female, several series; disk tubular, either all hermaphrodite or with the exterior florets female. Achænia compressed, beakless. Pappus 1 series.—Herbaceous or suffruticose; leaves alternate. Capitula hemispherical. Involucre 2–3 series. Receptacle naked, foviolately punctate. Florets of the ray white, blue, or purple; disk yellow. Widely diffused preferring alpine situations.

21. Rhynchospermum (Reinw. D. C. Prod. 5–296). Capitula many-flowered, radiate; ligulæ 2–3 series, female: disk hermaphrodite. Achænia compressed, attenuated at the base, short beaked. Pappus setose, 1 series; bristles twisted or inflexed at the apex.—Perennial herbs, extreme ramuli verticillate; leaves alternate. Capitula solitary in the axils of the leaves. Involucre hemispherical, imbricate. Receptacle convex scrobiculate. Colour of flowers? Java.

**** *Florets of the ray* 1 *series. Pappus of the ray and disk different.*

22. Stenactis (Nees. D. C. 5–298). Capitula many-flowered; those of the ray 1 series, female, narrow ligulate; of the disk hermaphrodite, 5-toothed. Achænia oblong, compressed. Pappus of the ray 1 series, setaceous, of the disk double, the exterior short, interior like the pappus of the ray.—Erect herbs with alternate leaves. Capitula solitary on the apices of the branches. Scales of the involucre 2–3 series. Receptacle naked, plain or convex. Ray florets white, or pale purple; disk yellow. Nepaul, Himalayas.

***** *Florets of the ray* 1 *series. Pappus squamulate.*

23. Asteromæa (Blume, D. C. 5–302). Capitula many-flowered; ray 1 series, female, ligulate; disk hermaphrodite. Stigmas of the disk lanceolate. Achænia 4-ribbed, somewhat compressed, attenuated at the base, somewhat glandulose, hairy. Pappus 1 series, united at the base, setaceously cleft at the apex.—Erect, glabrous herbs, with alternate leaves. Capitula solitary on the apices of the branches. Involucre 2 series; scales herbaceous at the apex. Ligulæ blue or white; disk yellow. Java.

****** *Florets of the ray* 1 *series. Pappus crown-like or wanting.*

24. Myriactis (Less. D. C. 5–308, R. W. Icon. 1091). Capitula heterogamous; flowers of the ray 2 or many series, female; ligula very narrow; of the disk hermaphrodite. Achænia compressed, beakless, often glanduliferous at the apex. Pappus none.—Erect, dichotomously ramous herbs with alternate leaves. Peduncles long, 1-cephalous, paniculate. Capitula globose. Involucre 1–2 series. Receptacle naked. Florets white or yellow. Himalayas, Neilgherries.

Div. III. Chrysocomeæ. *Receptacle naked, alveolate, or fimbriliferous. Capitula yellow either homogamous with all the florets tubular, hermaphrodite; or radiate, the ray florets ligulate, female or neuter.*

* *Ray florets several series.*

25. Psiadia (Jacq. D. C. 5–318). Capitula heterogamous, at first sight discoid though truly radiate, ray florets several series, very short; disk hermaphrodite or male by abortion, 5-toothed. Achænia of the ray oblong, glabrous, beakless. Pappus uniform, 1 series.—Shrubs with alternate petioled leaves and corymbose inflorescence. Involucre several series, imbricated. Receptacle sub-alveolate. Moluccus, Mauritius.

26. Microglossa (D. C. 5–320, Frivalia Endl.). Differs from the preceding in the disk florets which are 3–5-cleft, male.—Suffruticose, erect or somewhat voluble. Leaves alternate. Inflorescence corymbose. Pappus reddish. [I can see no satisfactory reason for separating this from the preceding.] Java, Penang, Moluccas.

** *Ray florets* 1 *series.*

27. Amphirhapis (D. C. 5–343). Capitula radiate; ligula 10–20, homochromous (same colour as the disk); disk florets 5-toothed, hermaphrodite. Achænia linear oblong, slightly compressed, villous or pubescent; the villi sometimes simulating an exterior pappus. Pappus 1 series, setaceous, rigid.—Perennial, erect herbs, with alternate leaves and corymbose capitula. Involucre imbricated. Receptacle alveolate. Flowers all yellow. Khassia, Nepaul, Ceylon.

Sub-tribe II. Baccharidæ. *Capitula heterogamous or dioicous, never radiate, all the florets tubular, usually several series of female ones in the circumference. Anthers ecaudate, receptacle epaleaceous. Leaves alternate.*

Div. I. Conyzeæ. *Capitula heterogamous, monoicous, capitula numerous, congested into a Sphærical glomerulus, sessile in the axils of the bracts.*

28. Blepharsipermum (Wight Herb. D. C. 5–368, R. W. Icon. 1092–93). Capitula 4-flowered, numerous, combined into a globose glomerulus. Flowers tubular, 2 exterior female, 3-toothed; 2 interior male, 5-toothed. Style not exserted, scarcely bifid. Anthers apiculate, sub-caudate at the base. Achænia oboval-oblong, compressed, subtetragonous; two of the angles nerve-like, glabrous, 2 marginal, ciliate. Pappus of the female flowers 3–5 palæ; of the male none.—Glabrous shrubs, leaves alternate. Glomerules globose, one or more on the ends of the branches. Involucre double. Receptacle of the capitula narrow, with a palea between the flowers. Courtallum, Mysore, Wynaud.

29. Athroisma (D. C. 5–368). Capitula numerous, combined into an ovate glomerulus. Axis of the glomerule cylindrical. Capitula several-flowered, heterogamous, 4–5 exterior flowers female, slender, 4–5-toothed; central ones few, male, wider above, 5-toothed. Achænia black, obcompressed oval, plano-convex, the marginal angle ciliate near the apex. Pappus sparing, sub-setose.—Erect, ramous herbs, suffruticose at the base; leaves alternate. Receptacles of the capitula bearing numerous concave membranaceous paleæ among the flowers. Involucre few-leaved, scarcely distinguishable from the paleæ of the receptacle. Martaban at Tragla.

30. Sphæranthus (Vaill. D. C. Prod. 5–369, R. W. Icon. 1094). Capitula heterogamous, several-flowered, densely aggregated into a globose glomerulus. Flowers all tubular; females thickened at the base, 3-dentate, several series in the circumference; males, by abortion of the style, in the centre, 5-toothed. Style in the centre florets undivided. Achænia beakless, pilose. Pappus none.—Herbs, with decurrent leaves, winged or wingless one-cephalous peduncles. Glomerules dense. Scales of the partial involucre numerous, 2–3 series. Partial receptacle naked, general bracteolate, flowers purple. A common plant in rice fields and other low, wet grounds.

31. Oligolepis (R. W. Calcutta Journal, not Cassini, R. W. Icon. 1149). Capitula numerous, heterogamous, about 5-flowered. Florets all tubular; females few (about 4), 1 series, pedicelled, slender, 3-dentate in the circumference; hermaphrodite in the centre, solitary, sessile, 5-toothed, sub-campanulate. Style in the central flower undivided. Achænia beakless, of the females terete, hairy, of the disk, obsoletely 4-sided, glabrous. Pappus none.—Glabrous herbs with decurrent, spathulate leaves, and dense, ovate oblong, axillary glomerules.

Involucre usually one scale to each floret, that of the hermaphrodite much larger, forming a common involucre to the capitulum, aristato-mucronate; those of the females linear, truncated at the apex and adhering at the base to the pedicels. Hermaphrodite corolla large, sub-campanulate, made up of a congeries of quadrangular cells, very fragile under the knife. [The plant which forms the type of this genus is *Sphæranthus amaranthoides* of Burman and D. C., but which is amply distinct both in structure and habit from *Sphæranthus*.] Peninsula, rare, Tanjore, Burmah, Ceylon.

** *Capitula not congested into a glomerulus. Pappus none.*

32. Dichrocephala (D. C. 5–371, R. W. Icon. 1095–96). Capitula heterogamous; florets all tubular; marginal ones female, many series, 3–4-toothed, central hermaphrodite or male few, 4-toothed. Achænia compressed, beakless, of the females bald, of the hermaphrodite crowned with 1–2 bristles.—Annuals with alternate leaves and small globose capitula, spreading involucre, and conical, naked receptacles. Flowers purplish. Himalayas, Neilgherries.

33. Grangea (Adans, D. C. 5–372, R. W. Icon. 1097). Capitula heterogamous; florets all tubular; of the circumference two or several series female, very slender, 3-toothed; of the centre hermaphrodite, 5-toothed. Styles of the disk undivided. Achænia obovate, somewhat compressed, attenuated at the base, crowned with an entire cup-shaped pappus, slightly fimbrillate on the margin.—Procumbent herbs, leaves alternate, sinuately pinnatifid. Capitula solitary, globose, terminal. Involucre 2 series. Receptacle hemispherical. Flowers yellow. A common weed near tanks in moist soil.

34. Cyathocline (Cass. D. C. 5–373, R. W. Icon. 1098, 1150). Capitula heterogamous; marginal florets many series, female, 3-toothed; central ones obconical, male, 5-toothed. Achænia oblong, attenuated at both ends, with a short pellucid beak. Pappus none (unless the beak be considered such).—Erect, herbaceous, viscid, heavy-smelling plants, with alternate bipinnatifid leaves. Capitula small, racemose, on the ends of longish, naked peduncles. Involucre many series. Receptacle ebracteolate, the centre elevated, saucer-shaped, bearing the male flowers. Flowers reddish purple. Nepaul, Prome, Neilgherries, Bombay.

*** *Capitula not congested into a glomerulus. Pappus pilose 1–2 series.*

35. Thespis (D. C. 5, Prod. 375). Capitula heterogamous; marginal florets many series, female, very slender; style scarcely exserted; central ones few, male, with short tube and campanulate limb. Anthers incluse. Achænia compressed, glabrous. Pappus 7–8 barbellate bristles.—Erect, ramous, glabrous annuals with alternate leaves. Peduncles axillary and terminal, bearing few congested capitula. Involucre several series, shorter than the disk. Receptacle naked, flat, punctulate. Flowers yellow. Pappus first white, afterwards reddish. Khassia Mountains.

36. Berthelotia (D. C. 5–375). Capitula heterogamous; florets of the circumference many series, female 2–3-toothed; of the disk few (5–12), 5-toothed. Achænia terete, beakless. Pappus 1 series, paleaceous, cohering at the base, scabrous at the apex.—A shrub with alternate, sessile leaves. Capitula oblong, forming dense corymbs on the ends of the branches. Involucre oval, scales several series, imbricated, adpressed. Receptacle naked, flowers purplish. Upper Hindostan, Banks of the Jumna.

37. Conyza (Less. Syn. D. C. 5–377). Capitula heterogamous; florets of the circumference many series, female, 3–5-toothed; of the disk few, male, 5-toothed. Achænia compressed, attenuated at the base. Pappus 1 series, bristles filiform.—Erect, ramous, terete herbs, with alternate leaves and corymbose or sub-paniculate, pedicelled capitula. Involucre many series. Receptacle ebracteolate punctulate or fimbriliferous. Flowers yellow, pappus red or reddish. Widely distributed, Bengal, Martaban, Peninsula.

Sub-tribe III. Tarchonantheæ. *Capitula either dioicous or heterogamous, never radiate. Female flowers in the circumference, many series, very slender; florets of the disk hermaphrodite or male, fewer and larger. Anthers caudate. Leaves alternate.*

Div. II. *Capitula heterogamous or monoicous.*

38. Blumea (D. C. 5–432, R. W. Icon. 1099, 1100, 1101). Capitula heterogamous, florets of the circumference many series, truncated, or 2–3-toothed; of the disk few (5–25) cylindrical, 5-toothed, the throat scarcely dilated. Anthers very slenderly caudate at the base. Achænia terete. Pappus 1 series, bristles capillary, scarcely rough.—Herbaceous or suffruticose plants with panicled or loosely corymbose inflorescence. Involucre imbricated, many series, scales linear acuminated. Receptacle flat, quite naked, or sometimes hairy. Flowers yellow or purple. Every where, all over India.

39. Pluchea (Cass. D. C. 5–449, R. W. Illust. tab. 131). Capitula heterogamous; florets of the circumference many series, female, truncated or 2–3-toothed; central ones few, male, or imperfectly hermaphrodite, 5-toothed. Anthers bicaudate at the base. Achænia erostrate, cylindrical or furrow-angled. Pappus 1 series, bristles filiform, scarcely rough.—Herbaceous or suffruticose, plants with alternate leaves, often glanduloso-pubescent. Capitula corymbose, pedicelled. Involucre many series, imbricated. Receptacle naked or hairy, fimbrillate. Flowers yellow. [This genus appears scarcely distinct from the preceding. D. C. remarks "à Conyza et Blumea antheris caudatis diversum," a very slender difference.] Eastern Islands, Mysore.

40. Monenteles (Labill. D. C. 5–455). Capitula many-flowered; marginal florets 2–3 series, females, scarcely dentate; of the disk 1–5 hermaphrodite or male, 5-toothed, externally sub-glandulose. Anthers of the disk with subulate spurs. Achænia oblong, sub-compressed, sparingly villous. Pappus 1 series, bristles filiform, connected at the base.—Ramous herbs with the leaves decurrent, forming wings to the stems. Capitula sessile, fasciculed in the axils of the floral leaves, forming spikes. Involucre 2-series, persistent, about equal, not imbricated. Receptacle flat, narrow. Burmah.

41. Epaltes (Cass. D. C. 5–461). Capitula heterogamous; florets of the circumference many series,

female; of the disk sterile. Anthers incluse. Styles of the disk scarcely exserted, undivided. Achænia of the ray obovate, subangled, glabrous. Pappus none. —Ramous herbs with alternate, decurrent leaves, peduncles opposite the leaves. Involucre two or several series, imbricated. Receptacle naked, convex. Indian Peninsula, common in rice fields.

Sub-tribe IV. Inuleæ. *Capitula never dioicous, rarely homogamous, often heterogamous, radiate. Ligulæ female, isochromous (colour of the disk). Receptacle, except* Rhantarium, *epaleaceous. Anthers caudate. Leaves alternate.*

Div. I. *Capitula several, many-flowered, not glomerulate.*

42. Inula (Gærtner D. C. 5-463). Capitula heterogamous; florets of the ray 1 series, female, or sometimes, by abortion, sterile, usually ligulate; of the disk hermaphrodite, tubular, 5-toothed. Anthers with two bristles at the base. Achænia erostrate, roundish. Pappus uniform, bristles capillary.—Herbaceous perennials. Capitula at the apices of the branches, solitary, often corymbose. Involucre imbricated, many series. Receptacle naked. Flowers yellow. Himalayas.

43. Vicoa (Cass. D. C. 5-474, R. W. Icon. 11-48). Capitula heterogamous; florets of the ray narrow ligulate, 1 series; of the disk tubular, 5-toothed. Anthers setaceously appendiculate at the base. Achænia beakless. Pappus of the ray none, of the disk capillary, 1 series.—Erect, ramous annuals with alternate, auriculately sagittate, sessile leaves; branches sparingly leafy, 1-cephalous. Involucre imbricated, scales subulate. Receptacle ebracteolate. Flowers yellow. Common weed all over the Peninsula.

44. Francœuria (Cass. D. C. Prod. 5-475). Capitula many-flowered, heterogamous; ray florets ligulate, short, 1 series, female; disk ones tubular, 4-toothed hermaphrodite. Achænium beakless. Pappus caducous, 1 series, bristles rough below, above barbellato-plumose, aglutinated at the base into a short ring, crowned with minute paleæ or bristles.—An erect under-shrub with alternate leaves; and 1-cephalous branches. Involucre campanulate, imbricated, receptacle naked, flat.—Flowers yellow. Banks of the Ganges, Behar.

45. Pulicaria (Gært. D. C. Prod. 5-477). Capitula many-flowered, heterogamous; ray florets 1 series, female, ligulate; disk ones tubular, 5-dentate, hermaphrodite. Achænia beakless, not compressed. Pappus 2 series, exterior crown-like, dentate, short; interior of rough bristles.—Erect, ramous, villous, odorous plants with cordato-sagittate leaves, frequent in marshy grounds. Peduncles 1-cephalous. Involucre loosely imbricated. Receptacle naked, areolate, flat. Flowers yellow. Mysore, Patna, Himalayas.

Div. II. Cæsulieæ. *Capitula 1-flowered, glomerate. Involucre 2-valved, afterwards aglutenated to the achænium.*

46. Cæsulia (Roxb. D. C. 5-482, R. W. Icon. 1102). Capitula numerous, aggregated in a glomerulus, or general head: proper involucre 2, carinated, membranaceous valves, at length cohering with the ovary and forming a spurious, 2-lobed pappus. Corolla tubular, 5-lobed, spreading. Anthers rigid, caudate. Branches of the styles exserted, filiform, diverging [Roxb. Icon. D. C.], or incluse and shortly spathulate [R. W. Icon.]. Achænia compressed, apparently 2-winged from the cohering-involucral scales. Pappus wanting [unless the elongated points of the involucre be considered such].—Herbaceous, diffuse plants. Leaves alternate, dilated, amplexicaul at the origin of the flowers. Flowers sessile, surrounded by 2-3 orbicular leaves and some small bracts, forming the general involucre, pale violet or white, opening from the centre towards the circumference. [This genus seems badly placed here, having apparently no affinity with the plants among which it is stationed.] Not uncommon in wet soil in sub-alpine situations.

Sub-tribe Buphthalmeæ. *Capitula usually heterogamous. Ray florets ligulate. Receptacle paleaceous. Pappus crown-like, torn or piloso-dentate.*

47. Buphthalmum (Necker. D. C. Prod. 5-483). Florets of the ray 1 series, broadish ligulate; tubes of all the corollas terete, narrow below. Achænia of the ray triquetrous, narrow, 3-winged; of the disk compressed, winged on the interior margin. Pappus scariose, crown-like, piloso-dentate.—Perennial herbs. Leaves linear lanceolate, entire. Capitula solitary, terminal. Involucral scales long, acuminate. Anthers scarcely caudate. A very doubtful Indian genus.

Sub-tribe Eclypteæ. *Capitula heterogamous, flowers of the ray female,* except Cryphiospermum, *ligulate; of the disk hermaphrodite: anthers ecaudate. Receptacle paleaceous. Pappus either none or aristate, never setaceous. Leaves opposite.*

48. Eclipta (Lin. D. C. 5-489). Capitula many-flowered, heterogamous; of the ray 1 series, female, shortly ligulate; of the disk tubular, 4-toothed. Achænia of the ray triangular, of the disk compressed, tuberculated on the sides, scarcely apiculate.—Rough, herbaceous plants with opposite leaves and solitary, axillary peduncles. Involucre 2 series, scales 10-12. Receptacle flat, covered with lanceolate paleæ. Flowers white; juice employed to dye black. Common weed every where in cultivated ground.

49. Blainvillea (Cass. D. C. 5-492). Capitula heterogamous; florets of the ray few, 1 series, expanding into a broad, short, irregularly 3-cleft ligula; of the disk tubular, 5-cleft. Style of the disk included. Achænia of the ray triquatrous, bearing 3 rigid, persistent, ciliate bristles. Of the disk compressed, biaristate.—Herbaceous plants with opposite triplinerved leaves. Peduncles axillary, monocephalous. Involucre cylindrical, 1-2 series, exterior ones foliaceous. Receptacle narrow, paleæ embracing the flowers concave, membranaceous. Flowers white. Like the preceding, common in cultivated grounds.

50. Siegesbeckia (Lin. D. C. 5-495, R. W. Icon. 1103). Capitula heterogamous; florets of the ray 1 series, ligulate or deformed; of the disk tubular, 3-5-toothed. Achænia obovate oblong, somewhat 4-sided, curved within, epappose.—Herbaceous, dichotomous plants, upper parts viscid. Involucre 2 series; five exterior ones linear, spathulate, spreading; interior ones, involving the achænia of the ray, viscidly pilose on the back. Receptacle flat. Paleæ embracing the achænia. Flowers yellow. Widely diffused over the Peninsula in sub-alpine or alpine jungles.

Tribe IV. Senecionideæ.

Sub-tribe. Melampodineæ. *Flowers unisexual, no hermaphrodites; male and female in different plants* (dioicous), *or in different capitula of the same plant* (heterocephalous), *or in the same capitulum* (monoicous): *anthers ecaudate; receptacle usually paleaceous: pappus never setose.*

Div. IV. Melampodieæ. *Capitula many-flowered, monoicous, radiate. Achænia corticate.* [*By "achænia corticate" is meant the achænia being wrapped in the scale of the involucre* or *palea of the receptacle, and so agglutinated to it that they form a single mass* or *become one body.*]

51. Melampodium (Lin. D. C. Prod. 5–517). Capitula many-flowered, monoicous; florets of the ray, 5–10, one series, ligulate, female; of the disk tubular, male. Achænia of the disk abortive, of the ray obovate or incurved, smooth, bald, more or less infolded within the interior scales of the involucre, hence often tuberculated, or rugous externally, and crowned at the apex.—Herbs or under-shrubs. Stems dichotomous, leaves opposite. Pedicels in the forks, 1-cephalous, involucre double, exterior scales 5 or 3, interior as many as there are florets in the ray. Receptacle convex or conical, paleaceous, paleæ diaphanous. Flowers yellow. Lucon, Philippines.

Div. V. Ambrosieæ. *Capitula male and female in the same plant; male involucre gamophyllous, many-flowered; female* 1- *or few-flowered. Anthers of the male free. Corolla tubular, sometimes wanting in the male.*

52. Xanthium (Tourn. D. C. 5–522, R. W. Icon. 1104). Capitula monoicous; male involucre sub-globose, many-flowered, scales free, 1 series; receptacle cylindrical, paleaceous. Corolla clavate, 5-lobed; filaments scarcely adnate to the corolla, anthers free. Female, 2 flowers enclosed within a 2-beaked, prickly involucre; corolla filiform; stigmas 2, diverging. Achænia one in each cell of the afterwards indurated involucre.—Herbaceous plants with variously divided leaves. Capitula irregularly glomerate, spicate, males above, females below. [D. C. well remarks of this, "a very abnormal genus among Compositæ, referred by Ventenat to Urticeæ, and by Reichenbach to Cucurbitaceæ." But for the venation of the corolla of the male flowers I would coincide with the former. The female has no corolla except the beaks, through an aperture of which the stigmas pass.] A very common weed in waste places among rubbish, &c.

Div. VII. Parthemieæ. *Capitula monoicous, radiate. Achænia of the ray obcompressed* or *rarely trigonous. Ligulæ long, adherent.*

53. Moonia (Arnott. D. C. 7, p. 288, R. W. Icon. 1105). Capitula monoicous; florets of the ray 1 series, female, ligulate, 3-cleft; of the disk male. Branches of the style of the female linear, revolute; style of the male incluse, simple, or slightly cleft at the apex. Achænia obovate, somewhat compressed, entire or shortly bicornate at the apex.—Shrubs: leaves opposite: peduncles terminal, 1-cephalous. Involucre 2 series, the exterior spreading, recurved, interior erect. Receptacle paleaceous, paleæ membranous, 1-nerved. Flowers yellow. [Owing to the Neilgherry species differing in several particulars from the Ceylon one, I have slightly modified the character for its admission.] Ceylon, Neilgherries—about the Avalanche and Koondah's abundant.

Sub-tribe. Heliantheæ. *Capitula usually heterogamous radiate, or homogamous discoid. Receptacle wholly, or at least the margin paleaceous. Lobes of the corolla of the hermaphrodite florets thick. Pappus none, crown-like,* or *aristate. Anthers blackish, ecaudate.*

Div. I. Heliopsideæ. *Capitula heterogamous, with ligulate, female ray florets,* or *discoid. Achænia large, usually furnished with thick, adherent bark, never obcompressed. Pappus wanting,* or *crown-like,* or *shortly aristulate.*

54. Wedelia (Jacq. D. C. 5–538, R. W. Icon. 1106–7). Capitula heterogamous; florets of the ray 1 series, ligulate, female; of the disk hermaphrodite, 5-toothed. Branches of the style of the hermaphrodite flowers ending in a cone. Achænia obovate or compressed, beakless, with a crown or calyx-like pappus. Receptacle paleaceous.—Suffruticose or herbaceous, leaves opposite. Pedicels terminal or axillary. Involucre 2–3 series, exterior foliaceous. Receptacle paleaceous. Generally diffused over India.

55. Wollastonia (D. C. 5–546, R. W. Icon. 1108). Capitula heterogamous; florets of the ray ligulate, 1 series, female; of the disk hermaphrodite. Corolla articulated above the ovary. Achænia thick, obovate. turbinate, or compressed, umbilicate at the apex, or bearing 5 slender aristæ.—Suffruticose, usually hispid, leaves opposite, triplinerved. Pedicels at the apices of the branches about 3, one-cephalous. Involucre 2–3 series, exterior foliaceous. Receptacle paleaceous. Flowers yellow. Like the preceding, a widely diffused genus.

56. Guizotia (Cass. D. C. 5–551, R. W. Illust. 132). Capitula heterogamous; ray ligulate, female; disk hermaphrodite, tubular, 5-toothed, base of the tube of the corolla furnished with a ring of thick jointed hairs. Achænia smooth.—Herbaceous: flowers large, terminal, pedicelled. Involucre 2 series, foliaceous. Receptacle paleaceous. Flowers yellow. [The only species, G. oleifera (Wight's Illust. tab. 132), is much cultivated in Mysore as an oil plant. It is a widely distributed plant.] Lower Bengal, Mysore.

Div. II. Rudbeckieæ. *Capitula heterogamous, ray florets ligulate, sterile. Achænia beakless. Pappus none,* or *crown-like.*

57. Sclerocarpus (Jacq. D. C. Prod. 5–566). Capitula many-flowered, heterogamous; ray florets 3, neuter, minute, irregularly ligulate, opposite the inner scales of the involucre; disk ones tubular, hermaphrodite. Corolla of the disk persistent, 5-toothed. Anthers scarcely adherent, prolonged at the apex. Branches of the style subulate. Achænia of the ray abortive; of the disk inclosed within the indurated paleæ.—Herbs; stem rough; leaves alternate, triplinerved. Involucre double; exterior foliaceous. Receptacle small, convex, the paleæ infolding the flowers of the disk and shorter than them. Corolla yellow.

Div. III. Coreopsideæ. *Capitula heterogamous, florets of the ray neuter. Achænia beakless, pappus sometimes 2 or 4 bristles, sometimes consisting of squamellæ and bristles.*

58. Helianthus (Lin. D. C. Prod. 5-585). Capitula many-flowered, heterogamous; ray florets ligulate, neuter, 1 series; disk ones tubular, hermaphrodite. Branches of the style appendiculate. Achænia laterally compressed or obsolately 4-angled. Pappus 2 crown-like scales.—Herbaceous plants with opposite, sometimes alternate leaves. Capitula large. Involucre irregularly imbricated. Receptacle flat or convex. Corolla of the disk short, throat dilated. Flowers yellow. [This genus scarcely merits a place in the Indian Flora, but as it is every where cultivated and is supposed by many to be an Indian plant, I have introduced it here.]

Div. IV. Bidenteæ. *Capitula heterogamous, florets of the ray neuter, rarely homogamous, discoid. Achænia beaked at the apex, usually prolonged into 1–4 awns beset with retrorse prickles.*

59. Bidens (Lin. D. C. 5-593). Capitula either homogamous, discoid, or radiate, with the florets of the ray ligulate, neuter. Achænia more or less obcompressed, surmounted by an aculeate beak, ending in 2–5 rigid, retrorsely-hispid bristles. Herbaceous annuals with opposite often divided leaves. Involucre 2 series, scales of each either similar or dissimilar. Receptacle flat, paleaceous. Flowers usually yellow, in one purple. A widely distributed genus.

Div. V. Verbesineæ. *Capitula heterogamous, florets of the ray ligulate, female rarely homogamous, discoid. Achænia with their bark usually compressed or obcompressed, bald, or prolonged into as many rigid awns as there are angles, rarely surmounted by pappus.*

60. Spilanthes (Jacq. D. C. 5-620, R. W. Icon. 1109). Capitula sometimes heterogamous, with the florets of the ray ligulate, female; sometimes homogamous, all the florets hermaphrodite, tubular 4–5-toothed. Branches of the style of the hermaphrodite florets truncated, penicilate. Achænia of the disk compressed, often ciliate on the edges.—Herbaceous annuals with opposite leaves, peduncles 1-cephalous. Capitula ovate or conical. Involucre adpressed, 2 series, shorter than the disk, exterior ones foliaceous. Flowers yellow. Plants usually pungent sialagoges. Common weeds, especially in shady places and in alpine or sub-alpine pastures.

61. Ximensia (Cav. D. C. 5-627). Capitula many-flowered, heterogamous; florets of the ray female, ligulate, 1 series; of the disk hermaphrodite, tubular, 5-toothed. Tube of the corolla hispid. Branches of the disk styles appendiculate at the apex. Achænia compressed, winged, deeply emarginate, subpilose, biaristate; aristæ cohering with the sides of the wings.—Herbaceous annuals with opposite or alternate, dentate leaves. Petioles winged and auricled at the base. Capitula loosely corymbose. Receptacle convex, paleaceous. Paleæ membranaceous, lanceolate. Flowers yellow. [D. C. seems not to regard this as an Indian genus: but as I have, apparently, native specimens, which may however have been introduced, I give it a place in this list.] Palamcotta.

62. Chrysanthellum (Rich. D. C. 5-630). Capitula radiate, ligulæ 1 series, female, linear, bidentate; disk hermaphrodite, 5-toothed. Branches of the style in the hermaphrodite florets appendiculate. Achænia bald, exterior ones oblong, emarginate or with a short cartilaginous wing on each side.—Herbaceous annuals: branches 1-cephalous at the apex. Capitula small. Involucre 2 series, scales of the exterior ones shorter, interior 10, somewhat coloured. Receptacle flat, with linear paleæ. Flowers yellow. Sukanugur.

63. Glossocardia (Cass. D. C. 5-631, R. W. Icon. 1110). Capitula few-flowered, florets of the ray 1–2 or 0, female; of the disk hermaphrodite, tubular, 4-toothed. Achænia of the disk obcompressed, very villous on the 4 angles, somewhat 2-winged, crowned with 2 rigid, smooth bristles from the lateral angles.—Herbaceous, diffuse plants with alternate pinnatifid leaves. Involucre oblong, imbricated. Receptacle covered with narrow, membranaceous paleæ. Capitula short peduncled: flowers yellow. A small weed common on pastures and waste grounds. Frequent in Coimbatore.

64. Glossogyne (Cass. D. C. 5-632). Capitula heterogamous, florets of the ray ligulate, female; of the disk, hermaphrodite. Styles of the hermaphrodite short, elongated into two long, rough stigmas. Achænia linear, angled, bearing two retrorsely hispid bristles.—Erect, glabrous herbs, with alternate, pinnatifid leaves congested near the base; stems nearly naked. Capitula erect, ebracteolate. Involucre short, adpressed, 2 series. Receptacle paleolate. Flowers yellow. In arid jungles under the shelter of stunted shrubbery, rather extensively diffused over the Peninsula.

Sub-tribe. Flaverieæ. *Capitula heterogamous, one- or few-flowered, densely aggregated, female flowers sometimes solitary, sometimes in several series, or homogamous, mixed with former. Achænia bald. Receptacle in the few-flowered capitula epaleate, in the many-flowered ones, paleaceous.*

65. Enhydra (Lour. D. C. 5-636). Capitula heterogamous, all the florets wrapped in a folded palea; exterior ones many series, female; interior hermaphrodite, sterile; tube of the ray florets filiform, of the disk subconical; limb of the ray sub-ligulate 3–4-cleft, of the disk 5-cleft. Stigmas exserted, revolute, rough towards the apex. Achænia bald, erostrate, altogether wrapped in the palea.—Aquatic, rooting, opposite-leaved herbs, with axillary capitula. Receptacle small, flattish. Paleæ as if 2-valved, connivent. Involucre 4-leaved, two opposite, larger. Flowers white. Bengal, Java, Cochin China.

Sub-tribe. Tagetineæ. *Capitula heterogamous with female ray florets, or homogamous discoid. Involucre usually one series or gamophyllus. Receptacle epaleaceous. Achænia erostrate attenuated at the base. Pappus aristate rarely bristled. Leaves opposite and with the involucre pellucedo-glandulose. [To this sub-tribe the common French Marigold belongs.]*

Div. II. Porophylleæ. *Capitula discoid, corolla of the disk unequally cleft. Branches of the style prolonged, subulate. Pappus setose, several series.*

66. Porophyllum (Vaill. D. C. Prod. 5-647). Capitula many-flowered, homogamous. Corolla regular, 5–6-

toothed or sub-labiate. Style exserted, acute, hispid at the apex. Achænia elongated, more or less beaked. Pappus several series, pilose, rough.—Herbs or undershrubs. Leaves alternate, usually perforated with large pellucid glands. Involucre often bluish purple, 1 series, scales at first cohering at the base. Receptacle naked, punctuate. Corolla dull purple. Nepaul, Phillipine Islands.

Sub-tribe. Anthemideæ. *Capitula usually heterogamous, radiate or discoid, ligulæ female or neuter. Anthers ecaudate. Branches of the style truncated, bearded, very rarely surmounted by a cone. Achænia angled, terete, or obcompressed in the ray. Pappus none or crown-like, rarely consisting of squamellæ or capillary hairs. Leaves usually alternate.*

Div. I. Euanthemideæ. *Receptacle paleaceous. Capitula radiate.*

67. Achilleæ (Lin. Neek. D. C. Prod. 6–24). Capitula many-flowered, heterogamous; ray florets 4–6 female, ligulate; disk ones tubular, hermaphrodite, 5-toothed. Tube of the corolla obcompressed. Achænia oblong, obcompressed, bald, not winged, but nerved on the margins.—Perennial herbs with alternate leaves. Capitula corymbose. Involucre ovate oblong, imbricating. Receptacle narrow, flattish, or elongated, rachis-like. Ray white, yellow, purple, ochre-coloured. Kemaon.

Div. II. Chrysanthemeæ. *Receptacle epaleaceous. Capitula radiate.*

68. Matricaria (Lin. D. C. 6–50). Capitula heterogamous, ray ligulate 1 series, female; disk hermaphrodite, 4–5-toothed, tube terete. Achænia wingless, angled, surmounted by a large epigynous disk, usually bald, rarely furnished with a crown-like pappus.—Annuals with much divided leaves; branches naked, 1-cephalous. Involucre imbricated, several series. Receptacle large, naked, ovato-conical. Disk yellow, ray white. Cashmere.

69. Pyrethrum (Gærtn. D. C. 6–53). Differs from the preceding in the achænia not being surmounted by an epigynous disk, but furnished with a crown-like, often toothed or auricle-like pappus equal to its diameter.—Annuals or perennials, leaves alternate, dentate, or lobed. Involucre campanulate, scales scariose on the margin. Receptacle flat, naked or sometimes bracteolate. Disk yellow, ray white or yellow. [To this genus Chrysanthemum Indicum, of the gardens, belongs.] India generally, one Cashmere.

70. Chrysanthemum (D. C. 6–63). This genus differs from the two preceding in having the achænia of the ray 3-winged, two lateral and the 3d on the interior side; those of the disk roundish, with a short wing on the interior side.—Herbs or shurbs. Ligulæ white or yellow, or white with a yellow tube. Disk yellow or rarely purple. Bengal.

71. Artemisia (Lin. D. C. 6–93, R. W. Icon. 1111–12). Capitula discoid, homogamous or heterogamous; florets of the circumference 1 series, usually female, 3-toothed, with a long, exserted, bifid style; of the centre 5-toothed, hermaphrodite, or male by abortion. Achænia obovate, bald, with a minute, epigynous disk.—Herbaceous or suffruticose; leaves alternate, variously lobed; capitula spicate or racemose. Involucre imbricated; scales dry on the margin. Receptacle epaleaceous, naked or hairy. Flowers yellow or purple. Plants more or less bitter and aromatic. Widely distributed. Alpine in their predilections.

72. Crossostephium (Less. D. C. 6–172). Capitula many-flowered, heterogamous; ray florets female, several series, filiform, scarcely denticulate, larger at the base; the rest hermaphrodite, fertile, cylindrical, large, 5-toothed. Achænia angled, wingless. Pappus numerous, minute, unequal, semilanceolate paleæ.—A whitish, tomentose shrub with alternate, firm, 3-lobed, cuniate leaves. Capitula globose or racemose. Involucre campanulate, several series. Receptacle naked, conical. Flowers yellow. Phillipines, China, Canton.

73. Tanacetum (Less. D. C. 6–127). Capitula homo- or heterogamous; one row or 3–4-toothed, female florets in the circumference, those of the disk 4–5-toothed. Achænia angled, glabrous, with a large epigynous disk. Pappus none or membranaceous, crown-like.—Herbs or shrubs, leaves variously divided. Capitula solitary or corymbose, globose. Involucre campanulate, imbricated. Receptacle naked, convex. Flowers yellow. Himalayas, Nepaul, Kemaon.

74. Myriogyne (Less. D. C. 6–139). Capitula heterogamous; marginal florets many series, female, tubular, scarcely dentate; central few, hermaphrodite, 4-toothed, with a short tube and campanulate limb. Achænia angled, wingless, epappose.—Very ramous, diffuse herbs: with alternate, obovate, dentate leaves. Capitula small, first terminal, afterwards lateral. Involucre 2 series. Receptacle naked, convex. Flowers yellow. Properties acrid and sternutatory. Extensively diffused, procumbent, inconspicuous herbs.

75. Sphæromorphæa (D. C. 6–140). Capitula heterogamous; marginal florets many series, female, scarcely dentate; central few, 4-toothed. Style bulbous at the base. Achænia cylindrical, striated, epappose.—Decumbent herbs with alternate leaves. Capitula globose, depressed, axillary. Involucre campanulate, 2–3 series, longer than the flowers. Receptacle naked [D. C. asks if this is sufficiently distinct from Myriogyne]. Peninsula, Cochin China.

76. Machlis (D. C. 6–140). Capitula heterogamous; marginal florets many series, not furnished with a corolla? or very minute. Central ones numerous. Corolla obconical, 4-toothed. Stigmas bearded at the apex. Achænia terete, sub-angled, sub-glandulose; of the marginal flowers bidentate, of the centre truncated at the apex.—Herbs with alternate, multifid, pinnate leaves. Capitula pedicelled, axillary. Involucre 2 series. Receptacle naked, punctulate. Bengal, Khassia, Nepaul.

Sub-tribe. Gnaphalieæ. *Capitula homogamous or heterogamous discoid, very rarely radiate, sometimes 1-flowered. Anthers caudate. Achænia crowned with a pilose or setaceous pappus, very rarely bald. Leaves usually alternate.*

Div. III. Hedichryseæ. *Capitula not glomerulate, receptacle epaleaceous.*

77. Helichrysum (D. C. 6–169, R. W. Icon. 1113). Capitula sometimes homogamous, florets all hermaphrodite, 5-toothed, sometimes heterogamous; marginal florets often very few, 1 series, female. Achænia beakless, sessile, with a terminal areola. Pappus 1 series, setæ roughish not plumose.—Herbs or shrubs with alternate leaves. Involucre imbricated, scales scariose, interior ones connivent or radiant. Receptacle flat, epaleaceous, naked, areolate, or fimbriliferous. Involucre white, purple, or yellow. Corolla yellow or purple. Neilgherries, Ceylon, Cochin China.

78. Gnaphalium (Don. D. C. 6–221, R. W. Icon. 1114–15). Capitula heterogamous; florets all tubular, marginal ones many series, female; disk ones hermaphrodite. Achænia somewhat terete, sub-pappillose. Pappus 1 series, scarcely rough.—Herbaceous or suffruticose, generally woolly or tomentose plants. Capitula often disposed in glomerules, terminal or axillary, fascicled, corymbose, or spicate. Involucra white, red, purple or yellow. Widely diffused, alpine plants, from the Himalayas to Ceylon.

79. Filago (Tourn. D. C. 6–247). Capitula heterogamous: marginal florets numerous, on an elongated, filiform receptacle, the apex only dilated and bearing a few male or hermaphrodite flowers. Achænia terete, papillose. Pappus of the central ones setose, filiform, of the margin wanting or dissimilar.—Tomentose herbs. Capitula axillary or aggregated on the ends of the branches, small. [There is a discrepancy between this generic character and that of *F. prostrata*, the central florets of that species being without pappus, the marginal ones having it: neither do I find paleæ on the receptacle of that species.] Like the preceding, but also extends to the plains.

Div. V. Antennarieæ. *Capitula dioicous, not glomerate. Style of the male florets simple, receptacle epaleaceous or the margin only paleaceous.*

80. Antennaria (Brown D. C. 6–269). Capitula dioicous or sub-dioicous, with an alveolate, convex receptacle. Female florets filiform, 5-toothed; male, anthers half exserted. Achænia terete. Pappus 1 series, setæ of the female flowers filiform, of the male clavate.—Herbaceous or suffruticose. Capitula corymbose. Involucre imbricated, variously coloured at the apex or scariose, never yellow. Flowers yellow. Himalayas.

81. Anaphalis (D. C. 6–271, R. W. Icon. 478–1116, 17, 18, 19). Capitula heterogamous, discoid; marginal florets few or many series, female; disk ones hermaphrodite, sterile, 5-toothed. Styles of the marginal florets long, exserted, bifid, of the disk undivided, obtuse. Achænia glabrous, obcompressed, sessile, erostrate. Pappus 1 series, uniform, bristles rough not clavate.—Herbaceous or suffruticose, woolly or tomentose plants, stems sometimes 1-cephalous, oftener polycephalous, corymbose. Scales of the involucre niveoscariose, lanceolate, several series, the middle ones with a brownish claw. Receptacle convex, alveolate. Alpine plants, Himalayas, Neilgherries, Khassia Mountains, Ceylon.

82. Leontopodium (Brown D. C. 6–275). Capitula heterogamous; ray florets female, 1 or several series, 3–4-denticulate; disk ones bisexual-sterile, infundibuliform, 5-toothed, with the style clavate at the apex. Achænia cylindrico-compressed. Pappus of the female barbellate, of the sterile flowers usually clavate.—Perennial mountain herbs, woolly-tomentose; leaves oblong or the lower one obovate. Capitula terminal, umbellato-corymbose, middle capitulum of the central corymb sessile; the female flowers 1 series, ebracteolate, earlier; the lateral ones short pedicelled, females many series, furnished with a woolly, foliaceous bractea, therefore glomerulate, bound by radiating floral leaves. Scales of the involucre adpressed, woolly. Receptacle convex, foveolate [apparently scarcely distinct from the preceding]. Himalayas.

Div. VII. Relhanieæ. *Capitula many-flowered rarely few-flowered, homogamous or radiate. Receptacle epaleaceous. Pappus none or crown-like.*

83. Carpesium (Lin. D. C. 6–281, R. W. Icon. 1120). Capitula heterogamous, discoid; marginal florets female, several series, disk, hermaphrodite. Anthers caudate. Branches of the style terete, obtuse, sub-glabrous. Achænia oblong, compressed, rostrate; rostrum beset with viscid glands. Pappus none.—Herbaceous, erect plants with alternate leaves. Capitula solitary on the ends of the branches. Involucre many series, imbricate, exterior ones sometimes foliaceous. Flowers yellow. Himalayas, Neilgherries.

Sub-tribe. Senecioneæ. *Capitula homogamous or heterogamous, discoid or radiate. Anthers ecaudate. Achænia crowned with setaceous or pilose pappus, rarely wanting, the marginal ones sometimes bald. Leaves alternate.*

Div. II. Erechthiteæ. *Receptacle epaleaceous. Capitula discoid, heterogamous; florets of the ray tubular, female.*

84. Cremocephalum (Cass. D. C. 6–297). Capitula heterogamous, marginal florets few, filiform, female. Branches of the style crowned with a short, hispid cone. Achænia terete, 10-ribbed. Pappus pilose, soft, several series.—Herbs, branches long, naked 1-cephalous. Involucre many-leaved, not imbricated, calyculate. Receptacle fimbriliferous, afterwards becoming, with the base of the involucre, thickened; flowers purple. India—where? Mauritius.

Div. III. Eusenecioneæ. *Receptacle epaleaceous. Capitula either homogamous, discoid or radiate. Cotyledons flat.*

85. Gynura (Cass. D. C. 6–298, R. W. Icon. 1121–22). Capitula discoid, homogamous. Base of the tube of the corolla corneus. Branches of the style produced into a long, hispid appendage, usually exserted. Achænia terete, striated, beakless. Pappus many series, filiform, scarcely barbellate.—Herbaceous or shrubby plants; with corymbose capitula. Involucre cylindrical, 1 series, calyculate at the base with subulate bracts. Receptacle flat, alveolate. Flowers white. Alpine plants, Himalayas, Khassia Mountains, Neilgherries, Ceylon.

86. Emilia (Cass. D. C. 6–301, R. W. Icon. 1123). Capitula homogamous, discoid; florets 5-lobed. Branches of the style ending in a cone. Achænia oblong, pentagonal, angles ciliate, hispid. Pappus several series, filiform, scarcely barbellate.—Herbs, with few sub-corymbose, pedicelled capitula. Involucre cylindrical, 1 series, ecalyculate. Flowers reddish, purple, or orange coloured. Widely diffused, common all over the Peninsula.

87. Ligularia (Cass. D. C. 6–313). Capitula radiate; ray 1 series, ligulate, female, often bi-ligulate, or retaining rudiments of the stamens. Branches of the styles of the disk obtuse, clothed with long, descending pubescence. Achænia beakless, sulcated, terete. Pappus uniform, pilose, many series.—Herbaceous plants. Capitula large, yellow, arranged in racemes or thyrses, or solitary: involucre campanulate, 1 series. Receptacle naked. Himalayas.

88. Doronicum (Lin. D. C. 6–320, R. W. Icon. 1124 to 29–1151). Capitula radiate, heterogamous; ray florets 1 series, ligulate, female, or sterile by abortion; disk hermaphrodite. Achænia beakless, oblong, turbinate, furrowed; of the ray bald, of the disk pappose. Pappus setaceous, several series.—Herbaceous plants, with solitary or several capitula. Involucre few series, scales linear. Receptacle convex, ebracteolate. [Almost the only distinction between this genus and Senecio consists in the marginal florets; in this having *no pappus*, in that being furnished *with pappus* similar to those of the disk.] Alpine plants, Himalayas, Khassia Mountains, Neilgherries, Ceylon, &c.

89. Madacarpus (R. W. Calcutta Journal, Icones 1152). Capitula radiate heterogamous; ray florets 1 series, ligulate, sterile; disk ones numerous, hermaphrodite. Achænia beakless, oblong, furrowed, hairy, without pappus.—Herbaceous plants. Capitula corymbose. Involucre campanulate, 1 series, scales linear, lanceolate, mucronate. Receptacle convex, foveolate. Corolla sub-infundibuliform. Costæ of the achænia hispid. Neilgherries.

90. Senecio (Less. D. C. Prod. 6–341, R. W. Icon. 1130 to 36). Capitula homogamous, discoid, or heterogamous, radiate; florets of the ray ligulate, female. Branches of the style of the hermaphrodite florets truncated, the point only penicillate. Achænia beakless, terete or angularly furrowed. Pappus pilose, several series, caducous.—Herbaceous or shrubby, sometimes climbing plants, with solitary or corymbose inflorescence. Involucre one series, sometimes naked sometimes calyculate with accessory squamellæ, often with the points of the scales sphacellate. Receptacle naked, alveolate. [D. C.'s list of species of this genus exceeds 600. It is therefore by much the largest genus of the vegetable kingdom.]—Every where, but in India nearly confined to alpine tracts.

91. Notonia (D. C. 6–44, R. W. Icon. 434). Capitula discoid, homogamous; florets 5-toothed. Branches of the style ending in a short, hispid cone. Achænia terete, many, striated, glabrous. Pappus many series, setæ filiform, barbellate.—Shrubby, succulent plants with corymbose, few-headed inflorescence. Capitula, as compared with the above genera, large. Involucre cylindrical, 1 series, ecalyculate, the peduncle furnished with a few bracteaceous scales. Receptacle alveolate, naked or slightly fimbriliferous. Flowers longer than the involucre, pale yellow or cream coloured. Found all over the Peninsula, from the level of the sea to Dodabella on the Neilgherries.

92. Madaractis (D. C. 6–439). I exclude this genus as being identical with *Doronicum*, and all its species previously described under that name. *M. pinatifida* is *D. Candolianum*—*M. scabra*, is *D. Lessingianum*—*M. polycephala*, *D. Arnottii*—*M. glabra*, *D. Wightii*. The distinctive characters of the two genera are, that in Doronicum the ray florets are *female*, in Madaractis *neuter*. In the character above given, I have combined them thus: "ray florets 1 series, female, or sterile by abortion."

Tribe V. Cynareæ.

Sub-tribe. Echinopsideæ. *Capitula sessile, one-flowered, aggregated into a globose glomorulus, with numerous involucral foliola, articulated on a globose, common receptacle.*

93. Echinops (Lin. D. C. 6–522). Capitula numerous, aggregated on a naked, globose, receptacle, the centre one opening first. Corolla tubular, 5-cleft. Anthers ecaudate. Achænia cylindrical, silky, villous. Pappus short, crown-like, the hairs somewhat fimbricated.—Erect, prickly plants. Glomerulus sphærical. Capitula inserted on a circular, horny, areola. Partial involucre 3 series. The interior scales the longest, linear, acuminated, carinate. Flowers blue or white. Widely diffused, extending from the Himalayas to Cape Comorin and Ceylon.

Sub-tribe. Carlineæ. *Capitula many-flowered, never dioicous. Scales of the involucre many series, distinct, often spinous. Hermaphrodite corolla, 5-cleft, female or sterile, deformed. Filaments free, naked. Anthers usually furnished with a long, bearded, cauda. Achænia usually villous. Pappus 1–2 series, pilose, or plumose, rarely ramose.*

94. Saussurea, (D. C. 6–531). Capitula homogamous. Corolla slender, throat ventricose. Anthers ending in long appendices with 2 ciliate bristles at the base. Stigmata long, diverging, continuous with the style. Achænia glabrous. Pappus usually double, paleæ of the exterior sub-filiform, rough, sometimes wanting, interior long, plumose, concreted at the base into a deciduous ring. Herbs with entire leaves. Capitula usually corymbose. Involucre many series. Receptacle fimbrillate or paleaceous, palea persistent. Corolla purple or white, never yellow. Himalayas.

95. Aplotaxis (D. C. 6–538). Similar to Saussurea, except that the pappus is one series, plumose. [Surely this is an unnecessary refinement, especially as it is said of the exterior series of Saussureæ, "*raro exter. deficiente nullus*," and Captain Munro, from whom I have a specimen collected by himself, informs me, that *Ap. gossipina* "is an undoubted Saussurea." Himalayas, Bengal.

96. Dolomiæa (D. C. 6–542). Capitula homogamous. Corolla slender, dilated at the base. Anthers appendiculate and caudate at the base; caudæ intorted, ciliate. Style thickened at the apex, ovarium glabrous, somewhat 4-sided. Pappus long, violaceous, bristles rough,

concreted into a ring at the base.—A herbaceous, unarmed plant, radicle leaves pinnatifid. Capitula short, peduncled, aggregated into an irregular head. Involucre ovate, many series, squamæ acuminate. Receptacle flat, covered with fimbrillæ forming alveolæ. Corolla purple, an inch long. Himalayas.

Sub-tribe. Centaurieæ. *Capitula many-flowered, discoid; florets of the circumference often sterile, enlarged or irregular. Filaments of the stamens free. Achænia furnished with an areola, more or less distinctly lateral. Pappus pilose or paleaceous, never feathery, sometimes wanting, at least in the circumference.*

97. Amberboa (Isnard, D. C. 6–558, R. W. Icon. 479). Capitula several-flowered, heterogamous; marginal florets larger, sterile. Achænia compressed or turbinate, tetragonal, with a lateral or basilar areola. Pappus paleaceous, paleæ obovate, spatulate.—Herbaceous plants. Involucre many series, scales various, rarely spinescent. Flowers blue, or reddish purple. Ceded Districts, Mysore, Coimbatore, Himalayas, Bengal.

98. Microlonchus (D. C. 6–562). Capitula many-flowered, florets of the ray neuter, more or less enlarged. Filaments pappillose; anthers ecaudate. Achænia compressed with a lateral areola. Pappus double, interior unilateral, broad at the base, acuminate at the apex, about the length of the exterior pappus.—Perennial, glabrous herbs. Floriferous branches naked, 1-cephalous. Involucre ovate, scales adpressed, coriaceous, with a short, reflexed, deciduous apex, or produced into a long, spine-like appendage. Flowers purple, or white, or yellowish. Himalayas.

99. Tricholepis (D. C. 6–563, R. W. Icon. 1139). Capitula homogamous. Corolla sub-regular, 5-fid. Achænia with a lateral areola, crowned at the apex with a circular margin. Pappus setaceous, concrete at the base, or paleaceous, not concrete, or wanting.—Herbaceous plants; capitula ebracteolate. Involucre many series, scales linear, setaceous, recurved at the points. Receptacle fimbriliferous. Himalayas, Ceded Districts, Mysore, Coimbatore.

100. Centaurea (Less. D. C. 6–565). Capitula many-flowered, heterogamous; usually radiate-like. Corolla of the ray usually sterile, dilated, 5-cleft, rarely hermaphrodite or not exceeding the disk. Filaments papillose, anthers ecaudate. Achænia compressed, having a lateral areola near the base. Pappus several series, rough, the inner ones smaller.—Herbaceous plants. Scales of the involucre various, appendiculate or exappendiculate, muticous or spinous. A large and polymorphous genus, abundant in Europe, and well known under the name of Corn-flower. Though occasionally met with in corn fields, scarcely an Indian genus.

Sub-tribe. Carthameæ. *Capitula many-flowered, homogamous, or rarely the exterior florets sterile. Involucre many series, exterior scales bract-like. Filaments bearded on the middle. Achænia glabrous, 4-angled, with a lateral areola. Pappus none or paleaceous, rarely pilose.*

101. Kentrophyllum (Neek. D. C. Prod. 6–610). Capitula homogamous, many- and equal-flowered. Corolla 5-cleft, regular, sometimes a few of the ray florets sterile, filiform. Filaments hispid in the middle from a tuft of hair; appendix of the anthers obtuse, stigma concrete. Achænia thick, obovate, sub-tetragonal, denticulato-crenate at the apex. Pappus on the marginal florets wanting; in the rest paleaceous, several series, the exterior ones membranaceous, ciliate on the margin, the inner ones shorter.—Erect, herbaceous, poly-cephalous annuals, with stem-clasping leaves. Capitula terminal. Involucre several series, exterior ones foliaceous, lobed, spinous; interior acuminato-spinous. Receptacle thick, fimbrillate. Flowers yellow, white or purple. Upper Bengal, Banks of the Jumna.

102. Carthamus (Tourn. D. C. 6–611). Capitula homogamous. Corolla 5-cleft, tube enlarged above the disk. Stigmata scarcely distinct. Achænia obovate, tetragonal, glabrous, smooth. Pappus wanting.—Herbaceous plants. Involucre several series, exterior foliaceous, middle ones with an ovate, spiny appendix; interior acuminate, pungent. Receptacle loaded with linear fimbrillæ. Flowers yellow or orange coloured. Moluccas. Cultivated in the Peninsula.

103 Onobroma (D. C. 6–613). Capitula many-flowered, exterior neuter. Corolla equally 5-cleft. Filaments glabrous, anthers appendiculate. Achænia subtetragonous, marginal ones bald, exterior pappiferous. Pappus many series of linear paleolæ.—Herbaceous, erect, spiny annuals. Capitula terminal. Involucre imbricated. Scales spinoso-acuminate. Receptacle fimbriliferous. West of India? but as yet doubtfully an Indian genus.

Sub-tribe. Carduineæ. *Capitula many- and equal-flowered, all hermaphrodite or dioicous. Involucre many series. Scales often spinous. Corolla 5-cleft. Filaments papillose or glabrous. Achænia glabrous, with a terminal areola. Pappus pilose or feathery, concreted into a ring at the base.*

104. Carduus (Gært. D. C. Prod. 6–621). Capitula equal-flowered. Corolla 5-cleft, tube short. Filaments pilose. Stigmas concrete. Achænia sub-compressed, with a terminal, not lateral areola. Pappus many series, filiform, scabrous, concreted into a ring at the base.—Erect herbs, with decurrent, often spinose leaves. Capitula erect, often pendulous after flowering. Involucre imbricated. Scales usually spinose at the apex. Receptacle fimbriliferous. Flowers purple, or varying to white. Choor—I can find no account of the species.

105. Cirsium (Tourn. D. C. 6–634, R. W. Icon. 1137). Capitula homogamous, hermaphrodite, or dioicous. Tube of the corolla short, throat oblong, 5-cleft. Anthers ecaudate. Stigmas concreted. Achænia oblong, compressed, glabrous, membranaceous, ecostate, with a fleshy, terminal areola.—Herbaceous, thistle-like plants. Involucre imbricated, scales more or less prickly pointed. Receptacle fimbriliferous. Flowers purple or yellow. Alpine plants in India. Neilgherries, Pulneys, abundant, Himalayas.

106. Chamæpeuce (Pr. Alp. D. C. 6–657). Capitula homogamous. Corolla 5-cleft, equal or subringent. Filaments plumose or hairy. Anthers with an oblong, acute appendiculus, and long, lacerated cauda. Stigmas scarcely free at the point. Achænia obovate, with a hard testa. Setæ of the pappus plumose, one or several series.—Suffruticose or herbaceous plants, with prickly

leaves. Capitula terminal or axillary. Involucre imbricated, scales more or less pungent. Receptacle fimbriliferous. Flowers purple or white. Himalayas, V. S. ex Herb. Munro.

107. Echenais (Cass. D. C. 6–660). Differs from the preceding, in the achænia being striated and the pappus double; the exterior setæ short, the interior long, dilated at the apex into a flattened, nail-like, membranaceous disk.—Erect, herbaceous plants: capitula nodding: flowers white. Himalayas.

108. Lappa (Tourn. D. C. Prod. 6–661). Capitula homogamous, equal-flowered. Corolla regular, 5-cleft, tube 10-nerved. Filaments papillose; anthers prolonged into filiform appendices. Stigmas diverging. Achænia oblong, compressed, transversely rugous. Pappus many series, short.—Herbs, with petioled, cordate leaves, and terminal, corymbose capitula. Involucre globose, imbricated. Scales hooked at the point. Corolla purple, varying to white. Himalayas.

Sub-tribe. Serratuleæ. *Capitula many-flowered, involucra many series. Scales scarcely spined. Flowers hermaphrodite or dioicous. Corolla 5-cleft. Filaments papillose or pilose. Anthers ecaudate. Achænia glabrous. Pappus pilose or feathery.*

109. Serratula (D. C. 6–667). Capitula usually homogamous, sometimes, by abortion, 1-sexual, or the ray female. Corolla 5-cleft, sub-irregular. Filaments pilose. Stigmas diverging. Achænia oblong, compressed, hilum oblique. Pappus unequal, hairs many series; rough, not annulate.—Unarmed or prickly herbs. Involucre ovate, scales imbricated, the exterior ones shorter, spinulose; interior long, scariose at the apex. Receptacle fimbrillate. Corolla purple or white, never yellow. Himalayas, Cochin China.

110. Jurinea (Cass. D. C. 6–673). Capitula homogamous. Corolla longer than the involucre. Stigmas distinct. Achænia obpyramidal, 4-sided, with an apicular areola, afterwards growing into deciduous shield, bearing the pappus. Pappus rising within a minute, calyciform margin, thick, unequal, barbellate.—Herbaceous perennials, leaves white, tomentose beneath. Involucre sub-globose or cylindrical, scales imbricated, unarmed, adpressed. Fimbrillæ of the receptacle cleft into linear bristles. Flowers purple. Himalayas.

LABIATIFLORÆ.

Tribe VI. Mutisiaceæ.

Sub-tribe. Mutisieæ. *Capitula very rarely 1-flowered, usually 1 series of females in the margin, the rest hermaphrodite. Style thick, branches exteriorly very convex in the hermaphrodite ones; the exterior as well as the superior part of the style puberulous or glabrous. Pollen often slightly elliptic. Shrubs or large herbs, with large, handsome capitula.*

Div. II. Eumutisieæ. *Anthers caudate.*

111. Ainsliæa (D. C. 7–13). Capitula 3-flowered, homogamous. Corolla tubular, bilabiate, exterior lip 3-interior 2-cleft. Anthers appendiculate, with long spurs at the base. Stigmas exserted, obtuse, glabrous, often, by abortion, unequal, acute, or one altogether abortive. Achænia terete, villous, erostrate. Pappus 1 series, setæ elegantly plumose.—Herbaceous perennials; stems erect, simple. Involucre cylindrical, scales lanceolate, acuminated, imbricate. Receptacle naked. Flowers purple. [This genus is dedicated to the late Dr. Whitelaw Ainslie, of Madras, an honour well merited in return for his most valuable Materia Medica of Hindoostan.] Himalayas.

112. Gerbera (Gron. Linn. D. C. Prod. 7–15). Capitula many-flowered, heterogamous; ray florets 1 series, liguliform. Corolla bilabiate, exterior lip 3-toothed, elongated in the ray; interior bidentate in the disk, bipartite in the ray, of the ray cirriform. Anthers glabrous in the disk, wanting in the ray. Achænia more or less rostrate. Pappus 2 series, setoso-paleaceous, serrated, equal.—Perennial herbs; scapes 1-cephalous. Involucre scales adpressed, oblong, receptacle naked. Flowers yellow or reddish, pappus reddish. Himalayas.

113. Oreoseris, (D. C. 7–17). Capitula heterogamous, radiate-like; marginal florets female; disk hermaphrodite. Corolla bilabiate, 2–3-cleft. Exterior lip of the ray ligulate, 3-cleft. Anthers long-spurred, spurs lacerated at the point. Style tumid at the base, branches short, obtuse. Achænia oblong, puberulous. Pappus 2 series, setæ serrated, equal.—Herbs: radical leaves lyrate or pinnatifid, tomentose beneath. Scape 1-cephalous. Involucre two or more series, scales acuminated. Receptacle naked. Flowers yellow. Himalayas.

114. Borniera (D. C. Prod. 7–18). Capitula many- and equal-flowered, homogamous. Corolla bilabiate; exterior lip 3-dentate, erect; interior, bidentate, revolute. Anthers surmounted by long, lanceolate, acuminate appendages, spur bearded at the point. Achænia elongated, shortly beaked. Pappus several series, bristles rigid.—Perennial, stemless herbs; leaves long, petioled, sagittato-cordate; scapes 1-cephalous. Involucre subcampanulate, 2–3 series. Receptacle naked, alveolate. Corolla purplish. Himalayas.

115. Leucomeris (Don. D. C. 7–25). Capitula 4–6-flowered, homogamous. Corolla tubular, 5-cleft, lobes linear, sub-callous at the apex. Anthers elongated, caudæ plumose. Style bulbus at the base, scarcely exserted; branches short, obtuse, glabrous. Achænia covered with silky villi surrounding the apex, like calycled pappus. Pappus several series, rough, rigid.—Shrubs or herbs: leaves alternate, tomentose beneath. Capitula corymbosely fascicled. Involucre glabrous, cylindrical, imbricated. Receptacle naked. Corolla purplish: anthers white. Himalayas.

116. Dicoma (Less. D. C. 7–35, R. W. Icones 1140). Capitula homogamous or heterogamous. Corolla of the disk regular, 5-parted; of the ray, in heterogamous capitula, neuter, ligulate, bilabiate or roundish tubulate. Anthers long, caudate, caudæ bearded. Branches of the style short, erect, obtuse, hispidulous at the apex. Achænia turbinate, often 10-ribbed. Pappus two or more series.—Suffruticose or herbaceous. Leaves alternate. Capitula solitary. Involucre campanulate. Scales obsoletely many-nerved, sometimes pungent. Receptacle alveolate. Flowers white or purple. Peninsula. Common in the Coimbatore district, in arid, gravelly soils.

LIGULIFLORÆ.

Tribe VIII. Cichoraceæ.

Sub-tribe. III. Hyoserideæ. *Receptacle epaleaceous. Pappus crown-like or many paleæ.*

117. Cichorium (Tourn. D. C. Prod. 7-83). Capitula many- or several-flowered. Achænia obovate, sub-compressed, striated, glabrous. Pappus consisting of 1-2 series of numerous, short, obtuse squamellæ.—Erect, ramous herbs. Capitula sessile in the axils of the upper leaves or terminal. Involucre double, exterior short, about 5 leaves, interior long, about 8-10-leaved. Receptacle flattish, epaleaceous. Flowers light blue. Plant bitter, becoming edible by cultivation. Himalayas, Patna.

Sub-tribe. VI. Scorzonereæ. *Receptacle epaleaceous; pappus paleolate, paleola rough or plumose.*

118. Tragopogon (Tourn. D. C. 7-112). Capitula many-flowered; florets of the ray often radiant. Achænia with a lateral areola, more or less muricated, long beaked. Pappus plumose, five of the sæta longer and naked at the apex.—Biennials or perennials; roots thick, lactescent; stems herbaceous, erect. Capitula terminal. Involucre 1 series. Receptacle epaleaceous, foviolate. Himalayas.

119. Scozonera (D.C. Prod. 7-117). Capitula many-flowered. Achænia estipitate, beakless, with a lateral areola. Pappus many series, plumose or rarely rough. —Herbs; roots fusiform or tuberous. Leaves usually quite entire, rarely dentate, or pinnatifid. Stem simple, 1-cephalous. Involucre imbricated. Receptacle naked. Flowers purple, or oftener yellow, with the ligulæ of the same colour, or purple. Himalayas.

120. Picris (Juss. D. C. 7-128, R. W. Icon. 1148). Capitula many-flowered. Achænia terete, attenuated at both ends, rugulose with a terminal areola, beak none or short. Pappus of the disk plumose, 2 series, exterior shortest.—Herbaceous plants. Capitula peduncled. Involucre 2 series. Receptacle naked. Alpine plants, Himalayas, Neilgherries.

Sub-tribe. VII. Lactuceæ. *Receptacle epaleaceous or rarely paleaceous. Pappus hair-like, fugaceous, soft, silvery white.*

121. Lactuca (Tourn. D. C. 7-133). Capitula few- or many-flowered. Achænia compressed, wingless, abruptly terminating in a filiform beak.—Herbaceous. Capitula paniculate. Involucre cylindrical, calyculately imbricated, 2-4 series. Receptacle naked. [The essential distinction of this genus is the filiform beak of the achænia, which is most marked in the common garden lettuce, but does not exist in either *L. glabra* or *L. Heyneana*, the only two Indian species I have examined. The former of these seems to associate better with *Microrhynchus;* the latter with *Brachyramphus.*] Himalayas. The Coromandel species do not belong to the genus, hence it is not a Peninsular genus, at least so far as I am aware.

122. Taraxacum (Haller. D. C. Prod. 7-146). Capitula many-flowered. Achænia oblong, striated, muricated along the ribs or spinellose at the apex, prolonged into a long beak. Pappus pilose, many series, very white.—Stemless, perennial herbs; leaves all radical. Scapes usually piped, 1-cephalous. Involucre double, exterior scales small, interior 1 series, cornulate at the point. Receptacle naked. Flowers yellow, exterior ligulæ often reddish. Himalayas, Oude.

123. Ixeris (Cass. D. C. 7-151). Capitula many-flowered. Achænia oblong, acutely 10-costate, beaked. Pappus pilose, 1 series.—Herbaceous. Stems naked at the apex, corymbose. Involucre ovate, 1 series, with 3-5 calyculate scales. Receptacle naked. [This genus, so far as I can learn from written characters, is not distinct from *Lactuca*, *L. sativa*, being apparently about as justly referable to the one as the other.] Himalayas.

124. Brachyramphus (D. C. 7-176, R. W. Icones 1146). Capitula 10-15-flowered. Achænia oblong, muricate, suddenly attenuated into a short beak, neither angled nor costate. Pappus many series.—Herbaceous; capitula racemosely spicate. Involucre oblong, imbricated, the scales scariose on the margin. Receptacle naked. A common weed—often mistaken for some kind of Swine thistle.

125. Microrhynchus (Less. D. C. 7-180, R. W. Icon. 1145). Capitula several-flowered. Achænia 4, rarely 5-angled, sub-rostrate at maturity; beak wanting in the ovary. Costæ thick, sub-rugose. Pappus pilose.—Herbaceous perennials. Involucre cylindrical, calyculate, imbricate at the base. Receptacle naked. Flowers yellow. Widely diffused, humble plants, extending from the sea beach to the highest peak of Dodabet.

126. Sonchus (Cass. D. C. 7-184, R. W. Ic. 1141-42). Capitula many-flowered. Achænia wingless, compressed, erostrate, longitudinally costulate. Costulæ often transversely tuberculato-muricate. Pappus soft, most slenderly filiform.—Herbaceous, polymorphous plants. Involucre imbricated. Receptacle naked. Flowers yellow. Every where.

127. Youngia (Cass. D. C. 7-192, R. W. Icon. 1147). Capitula about 12-flowered. Corolla pilose at the apex of the tube. Achænia oblong, compressed, sub-trigonous, striated, beakless, attenuated at both ends. Pappus pilose, scarcely denticulate.—Herbaceous plants; inferior leaves lyrate or pinnatifid. Capitula paniculate. Involucre cylindrical, 8-leaved, with about 5 calyculate, accessory scales. Receptacle naked. [D. C. considers this a good genus, but adds that all the species require to be re-examined.] A common weed, growing in waste ground among rubbish, &c.

128. Prenanthes (Cass. D. C. 7-194). Capitula 3-5-flowered. Style exserted. Achænia attenuated at the base, sub-cylindrical or sub-pentagonal, truncated. Pappus many series, pilose, rigid.—Herbs with entire or dentate leaves. Capitula racemose or paniculate, drooping. Involucre 4-6-leaved, cylindrical, calyculate at the base. Flowers purple. Himalayas, Java.

Sub-tribe VIII. Hieracieæ. *Receptacle epaleaceous. Pappus filiform, rigid, fragile, becoming dirty white or yellow.*

129. Hieracium (Linn. D. C. Prod. 7–199). Capitula many-flowered, homocarpous. Achænia erostrate, striated or sub-prismatic. Pappus setaceous, 1 series, bound by the short annular margin of the achænium.—Perennial herbs, sprinkled all over with dentate, glandulose or stellate hairs. Involucre polyphyllous, scales unequal, imbricated. Receptacle naked, scrobiculate. Flowers yellow. Himalayas, Khassya Mountains.

130. Dubyæa (D. C. 7–247). Capitula many-flowered. Achænia compressed, striated, ending in a short thick neck. Pappus many series, white.—Herbs with undivided, dentate leaves. Capitula few, sub-corymbose. Involucre campanulate, imbricated, exteriorly hispid or prickly. Corolla yellow. Himalayas.

131. Mulgedium (Cass. D. C. 7–247, R. W. Icon. 1144). Capitula many-flowered. Achænia glabrous, compressed, often nerved on both sides, attenuated upwards into a short, thick beak, expanding at the apex into a cup-shaped disk. Pappus one or several series, setæ rigid, rough, greyish or white.—Erect, ramous herbs, with pinnatifid leaves and racemose or panicled capitula. Involucre calyculately imbricate, that is, the exterior scales are much shorter and sub-imbricate. Receptacle naked, foviolate. Flowers blue or purple. Alpine plants, both in India and Europe, Himalayas, Neilgherries.

EXPLANATION OF PLATE 131.

1. *Pluchea Indica.* Natural size. Copied from Roxburgh's drawing, lodged in the Calcutta Bot. Garden.
2. A detached capitulum, showing the imbricated involucre and form of the scales.
3. The same cut vertically, showing the receptacle.
4. A detached female floret with its palea.
5. —— male floret.
6. The same split open to show the insertion of the stamens.
7. A female floret split open.
8. A detached palea.
9. Anthers.
10. Branch of the style.
11. Achænium, showing its angular conical form.
12. The same cut vertically, showing the erect seed.
13, 14. The figures, of the male and female florets, appertaining to the original drawing. The rest of the analysis was prepared from a dried specimen which accompanied the drawing.

EXPLANATION OF PLATE 132.

1. *Guizotia oleifera.* Natural size, from a cultivated specimen.
2. A detached ray floret with its palea.
3. A disk hermaphrodite floret, showing the ring of hairs at the base of the corolla.
4. Disk floret split open, to show the insertion of the stamens, with its palea detached.
5. Ovule, separated from the pericarp, style and stigma.
6. Mature achænium.
7. Same cut transversely.
8. Cut vertically, seed erect.
9. Receptacle. Half the involucre removed to show the paleæ within.

EXPLANATION OF PLATE 133.

1. *Microrhyncus sarmentosus.* Natural size.
2. An unexpanded capitulum, showing the involucre imbricated at the base.
3. A detached floret.
4. Same split open, showing the insertion of the stamens.
5. Anthers, back and front views.
6. An immature achænium and pappus.
7. A seta of the pappus.
8. An achænium cut transversely, 5-angled.
9. Achænium cut vertically.
10. Embryo detached.
11. Receptacle—naked, sub-alveolate.

EXPLANATION OF PLATE 134.

This plate contains analyses, similar to the preceding, of 8 genera, representing the Tribes of Compositæ found in India. As the parts shown in each are the same as those named above, it does not seem necessary to go over each. I shall therefore simply name the genera, referring the reader to the preceding generic characters for further explanations.

1. Vernoneaceæ. Vernonea cinerea.
2. Eupatoriaceæ. Ageratum conyzoides.
3. Asteroideæ. Siegesbeckia orientalis.
4. Senecionideæ. Notonia grandiflora.
5. Cynareæ. Tricholepis Candolliana. [An undescribed species.]
5. Cynareæ. Amberboa Indica.
6. Muticiaceæ. Dicoma lanugenosa.
7. Cichoraceæ. Picris hieracioides γ. Indica.

Coloured by E.A. Rodrigues. W. Winchester Lith.

PLUCHEA INDICA.

Rungia del. Coloured by E.A. Rodrigues. W. Winchester Lith:

GUIZOTIA OLEIFERA.

கானயெள்ளு
Canayelloo } Tam.

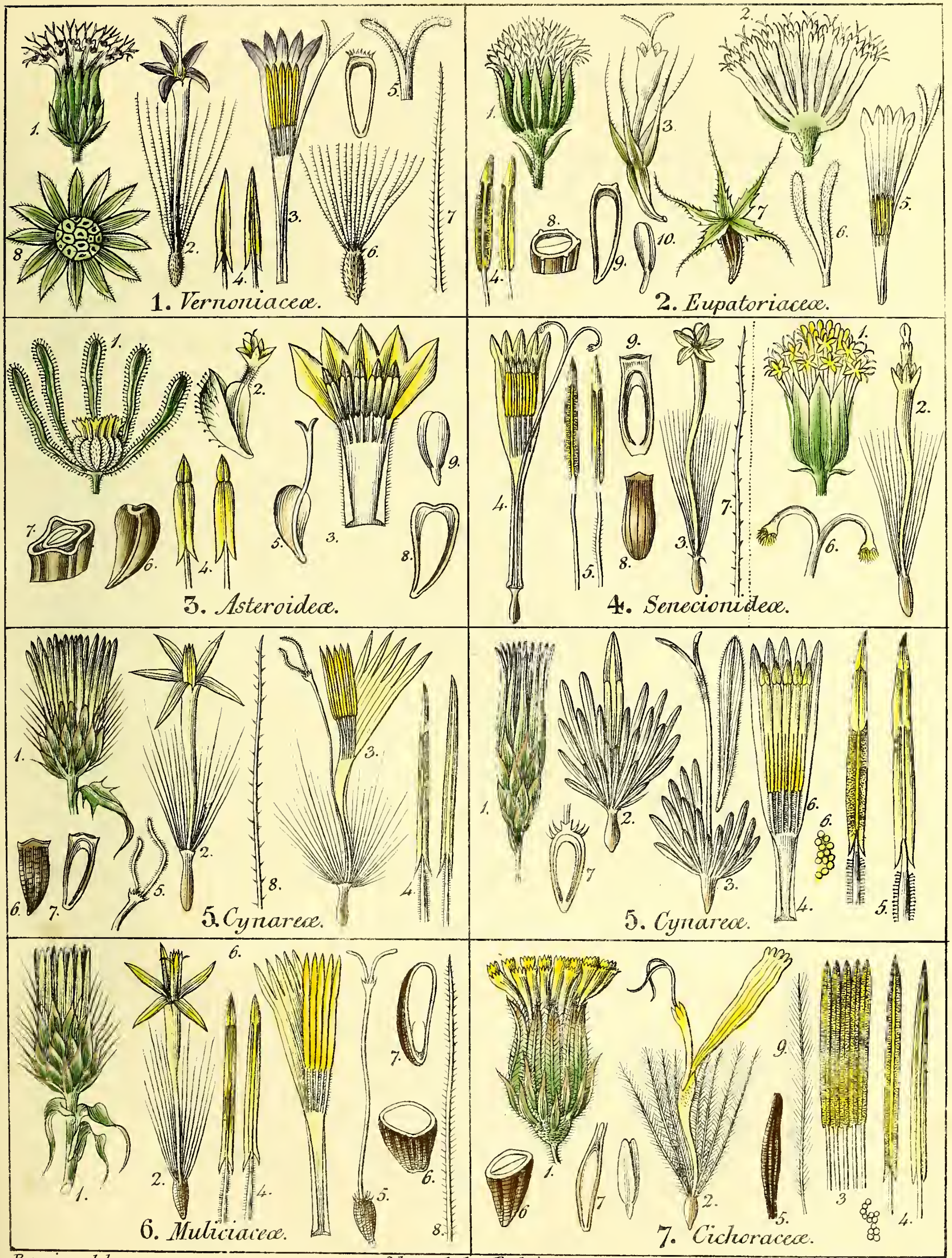
కొండనువ్వులు
Conda-noovooloo } Gen.

Rungia del. *Coloured by Rodrigues.* *Winchester Lith.*

MICRORHYNCUS SARMENTOSUS. *(D.C.)*

எழுத்தாணிப்பூண்டு
Ellothane-poondoo } *Tam.*

LACTUCA - SARMENTOSA. *(R.W.)*



Burgia del. Coloured by Rodrigues. Winchester Lith.

CAMPANULINEÆ.

Passing from the Epigynous, Monospermous group of Aggregatæ, including *Valerianœe*, *Dipsaceœ*, and *Compositœ*, we enter upon the consideration of a new series of Epigynous families, differing from the preceding in having several-celled ovaries with numerous ovules. These have been associated under the above name, as being more nearly allied to each other than to any other families. They were, in the first instance, combined into one order by Jussieu, under the name of Campanulaceæ. From this Brown separated *Goodenovieœ* and *Stylidieœ*, and indicated *Brunoniaceœ* as the type of a new Order: but retained *Lobeliaceœ* as a section of *Campanulaceœ*, in which he has been followed by Alph. De Candolle and Arnott. Bartling, however, considered that section entitled to rank as a distinct order, and has been followed by all subsequent writers. He, at the same time, grouped these orders into a class, which he designated CAMPANULINÆ, which has been adopted by Endlicher and Meisner.

As a single order, the plants associated in this class would assuredly form a somewhat heterogeneous assemblage, but notwithstanding they all appear so nearly related that I should not be surprised to see several of these families reunited and reduced to the rank of sub-orders, which, while they served all the purposes of practical convenience, would I think prove more in accordance with the principles of a natural arrangement, the object of which is to form circular groups, linked together by few but comprehensive characters. Of this description Endlicher's character of his "class" Campanulinæ may be taken as an example:

"Herbs or shrubs, rarely arborious. Leaves alternate or opposite. Stipules none. Flowers bisexual, inflorescence various. Tube of the calyx adherent to the ovary, with the limb superior, rarely free. Corolla perigynous or rarely hypogynous, regular or irregular. Stamens inserted with the corolla, sometimes scarcely distinct from it. Ovary rarely 1-celled, usually several-celled. Ovules rarely definite and erect from the base, very often numerous, ascending, anatropous, attached to central placentæ. Fruit capsular, baccate, or nucamentaceous, 1- or many-seeded. Seed albuminous, rarely exalbuminous. Embryo central, orthotropous radicle inferior."

The plants embraced within this character are all nearly related to each other by numerous intermediate characters, while they present various points of relationship with surrounding orders, which, however, are more or less weakened by sub-division into so many independent families. Sub-division is however indispensable to enable us to grapple with the host of species it includes; but it still remains a question to be solved by the researches of the Philosophical Botanist, whether these sub-divisions ought to retain the rank of independent families or of sub-orders. This question it is not my intention to examine, as it would lead me into details incompatible with the object of this work, which is rather to place before the Indian Botanist a view of the science as it now exists, than to attempt innovations, which I have neither the means nor leisure to work out to a satisfactory conclusion.

LXXXVIII.—LOBELIACEÆ.

A considerable family of, for the most part, herbaceous plants, most abundant in the tropical and sub-tropical parts of America, but also met with in Europe. In the tropical parts of India they are rare, except in alpine tracts, where they are more frequent, but no where numerous, as regards species, though individually abundant.

It is a curious family generally easily distinguished by the way in which the corolla is split along the back, and by the anthers being united, as in Compositæ, forming a tube round the style. Being nearly related to *Campanulaceœ*, Jussieu placed the genera, known to him, in that order, and Mr. Brown retained that distribution of them in his Flora of New Holland, but formed a sub-order of them. Since that time, Botanists generally seem to have agreed in thinking that these two families should be kept distinct partly, perhaps, if not principally, on account of the great difference in their properties which, in this, are intensely acrid and poisonous, in that mild and innocuous. As regards habit and organization, they are very much alike, with the exception

of the cleft, irregular corolla and united anthers of the one, and regular corolla and free anthers of the other.

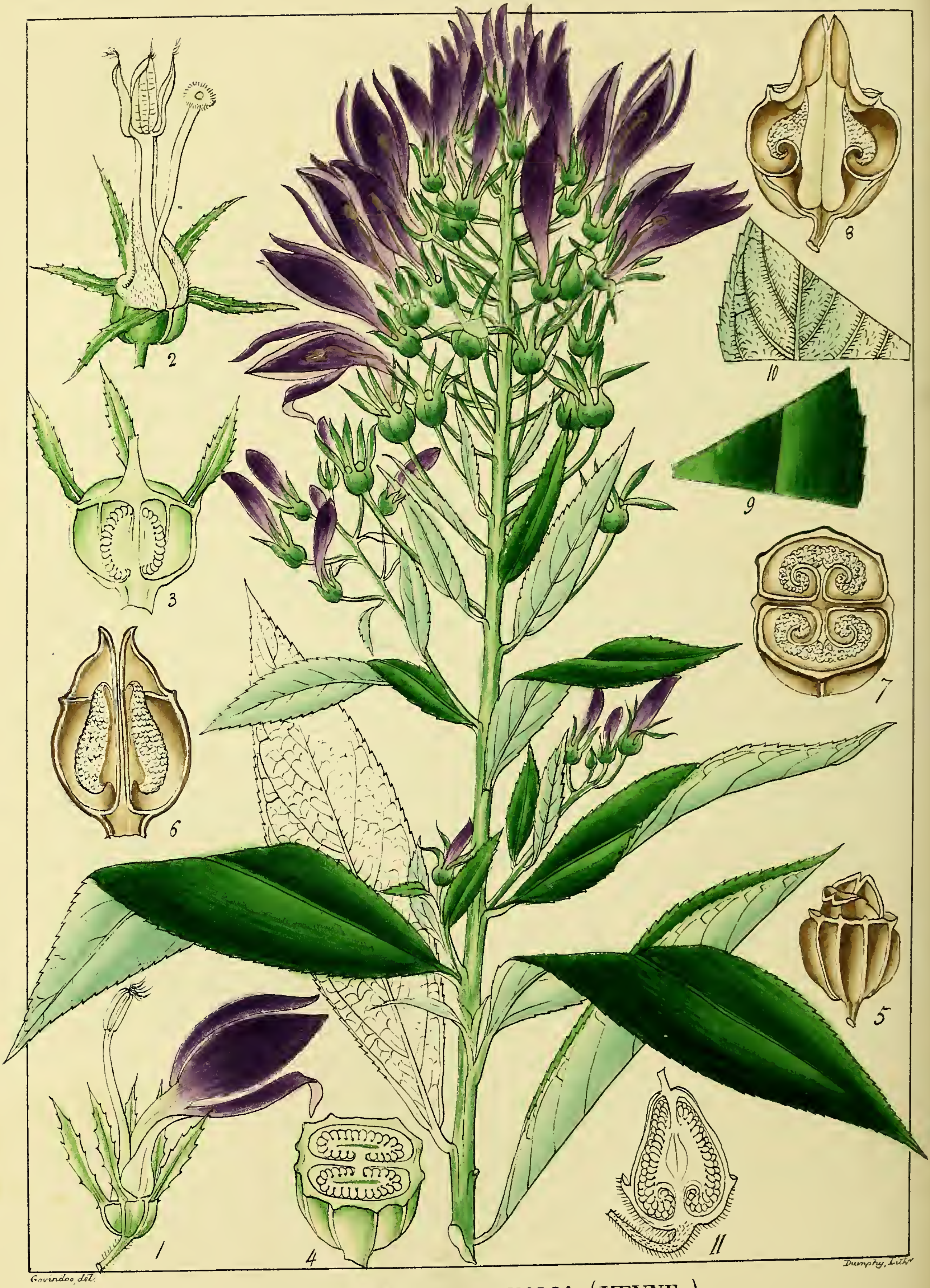
Character of the Order. Calyx 5-lobed, more or less adnate to the ovary, lobes usually equal and persistent. Corolla persistent, more or less divided, the lobes or petals alternate with the divisions of the calyx, often irregular, two- or one-lipped, or two petals free and three united, sometimes nearly regular; the tube entire or cleft longitudinally, the fissure between the lobes of the smaller lip, before flowering, inferior, afterwards, through a twist of the flower (resupination), usually above or opposite to the axis of inflorescence. Æstivation sub-valvate. Stamens 5, alternate with the lobes of the corolla, sometimes free, sometimes attached to the petals: filaments usually free at the base, more or less united above: anthers connate, two-celled, introrse, opening longitudinally; the inferior ones smaller, usually furnished at the apex with a tuft of hairs or bristles; the upper ones naked or bearded. Pollen, when dry, ovoid, smooth, often furrowed. Ovary inferior or half superior, two- or rarely one-celled, the placentæ then parietal. Ovules numerous. Style 1; stigma bound by a ring of hairs, long, covered by the anthers, usually 2-lobed. Fruit usually dry, opening at the apex by two septiferous valves, or more rarely by an operculum, or 3 lateral valves, or is indehiscent. Seed numerous. Albumen fleshy. Embryo straight.

Milky, herbaceous, or suffrutescent plants, or rarely small trees, with alternate, exstipulate, penninerved leaves; inflorescence various, axillary, solitary, or racemose; pedicels twisted when blooming; flowers usually blue, but sometimes red or yellowish.

Affinities. The structure and habit of the plants of this family very evidently associate them with those of *Campanulaceæ* and *Goodenovieæ*, differing from the former in their irregular corolla, cohering anthers, and often more numerously-celled ovary: and from the latter in their indefinite, albuminous seed, and naked, not indusiate stigma. On such grounds these three orders are kept distinct by most modern Botanists, but the propriety of this sub-division may well be doubted. Jussieu at first united the whole, but afterwards separated Lobeliaceæ, which, since that time, has been kept distinct by nearly all writers, Alphonse De Candolle, Arnott, and Harvey, in his South African Genera, still, however, viewing it as only a tribe of *Campanulaceæ*. For myself, I incline to join the minority, not thinking the distinguishing marks of ordinal value. Mr. Brown excluded the Goodenovieæ, forming them into a new order, mainly on account of their indusiate stigma. This seems a narrow basis for an order to rest upon. They are also near allies of some *Compositæ*, especially *Cichoraceæ*, agreeing in habit in their milky juice, in the irregularities of their flower, and in their united anthers: but differ abundantly in their several-celled ovary, and numerous, albuminous seed. *Brunoniaceæ* and *Stylideæ* are associated as very nearly allied orders, neither of them have representatives in this portion of India, and I am unacquainted with both. Both seem most anomalous forms, especially the former, which, however, judging from figures and descriptions only, seems scarcely well placed in this neighbourhood, but I cannot suggest a more suitable station, as it certainly has many points of affinity.

Geographical Distribution. Out of about 300 species referred to this order, only 14 or 15 are Indian, and these, with two or three exceptions, are alpine plants. Those found on the plains, generally inhabit moist ground, low wet pastures or the banks between paddy-fields. In America, Australia, and the Cape of Good Hope, they abound, but are more sparingly met with in the northern hemisphere, and are rare in Europe; two only are natives of Britain.

Properties and Uses. The milky juice of the plants of this family is, for the most part, excessively acrid, and some of the species of Lobelia are known to be intensely poisonous. *Lobelia Tupa* (Tupa Fenillei. Don), *Lobelia longiflora* (Isotoma longiflora, Presl.), *Lobelia infesta*, and *Lobelia urens*, are all remarkably acrid and poisonous. Among the Indian ones no such properties seem as yet to have been discovered, as no mention of any of them occurs in the work of any writer on Indian plants. The name does not even occur in Ainslie's Materia Medica. It may however be well to look on them with suspicion, as it seems scarcely probable they can be innocent, while so many of the family are known to be the reverse.



Govindoo, del. Dumphy, Lithr.

LOBELIA NECOLIANIFOLIA (HEYNE.)

Remarks on Genera and Species. The old genus Lobelia has, by recent writers, been broken up, and no fewer than 23 genera of *Lobeliaceæ* now find the name *Lobelia* among their synonyms. To what extent all these genera are well founded I am quite unable to say, being acquainted with only two or three of them. All the Indian species, except two, are still placed in the original genus, and I have not specimens of either of the off-shoots for examination. The most remarkable among the Peninsular species is undoubtedly *L. excelsa*, so abundant on the Neilgherries, a most ungraceful looking plant, growing as it does to the height of from 8 to 12 feet, the lower half quite naked, the middle thickly covered with leaves, and ending in a long, dense, tapering spike of pale yellowish, or slightly variegated flowers, but so intermixed with leafy bracts, as to be almost concealed by them. In Ceylon there is a nearly allied species, named *L. aromatica* by Moon (Wight's Ic. No. 1172). *L. trichandra* (R. W. Icon. No. 1171) is another large species, nearly allied to *L. Nicotianifolia*, and abounds on the western slopes of the Neilgherries, below Sispara, flowering in February and March.

EXPLANATION OF PLATE 135.

Lobelia Nicotianifolia. Flowering branch.
1. Detached flower.
2. The same, the corolla removed, showing the epigynous insertion of the stamens, the anthers forcibly separated and each bearded at the apex.
3. Ovary cut vertically.
4. —— cut transversely.
5. Mature capsule after dehiscence.
6. The same cut vertically, showing the position and attachment of the placentæ.
7. The same cut transversely, showing the inflexed placentiferous, carpellary margins.
8. Half of the capsule divided loculindally as in natural dehiscence.
9, 10. Upper and under surfaces of the leaves.
11. Ovary of *Lobelia excelsa*, showing that it is nearly free, not adherent to tube of the calyx as in the other.
All more or less magnified.

LXXXIX.—CAMPANULACEÆ.

In the Flora of the world this elegant and innocent family holds a prominent place, embracing about 25 genera, and probably not fewer than from 450 to 500 species. These are widely distributed over extra-tropical regions, but within the tropics are very rare, except in alpine situations. The plains of India only furnish three or four species, and not a single true *Campanula*, those described under that name being all referable to *Wahlenbergia*. On the Neilgherries there are three if not four Campanulas, and I think two Wahlenbergias, hence, as an Indian family, it is one of very secondary importance. Alph. De Candolle, who has published an admirable monograph of the order, thus characterizes it:

Character of the Order. Calyx usually 5-lobed, occasionally 3–6–8- or 10-lobed, adnate to the ovary, the lobes equal. Corolla, petals united (gamopetalous), regular, or rarely somewhat irregular, divisions alternate with the lobes of the calyx, valvate in æstivation. Stamens 3–5–6–8 or 10, usually equalling, never exceeding the lobes of the corolla, alternate with them, and not adhering to the tube: filaments usually dilated, membranaceous at the base: anthers for the most part free, the cells bursting longitudinally before dehiscence. Pollen grains (when dry) sphærical, rough with minute papillæ. Ovary inferior, 2–10-celled, in *Merciera* 1-celled from the incomplete partitions. Ovules numerous, in *Merciera* 4. Styles more or less covered with caducous, collecting hairs. Stigma naked, sometimes bound with an indusium, usually branched, the branches equalling the cells of the ovary, erect in the flower-bud, hairy on the back, papillose within, diverging or recurved in the flower. Cells of the ovary, when equal to the lobes of the calyx, either alternate or opposite to them. Capsule dehiscing at the apex or sides, the valves for the most part bearing the partitions more rarely without valves, opening by pores or fissures. Seed numerous, small, embryo straight, albumen fleshy. Herbaceous, rarely suffruticose, milky plants, most frequent in temperate regions. Leaves exstipulate, alternate, or rarely opposite, often dentate. Inflorescence either definate, centrifugal or obscurely indefinate, in that case the flowers terminating, the lateral branches opening first. Flowers solitary or glomerate, generally pedicelled; seldom involucrate. Corolla usually blue, sometimes yellow or purple.

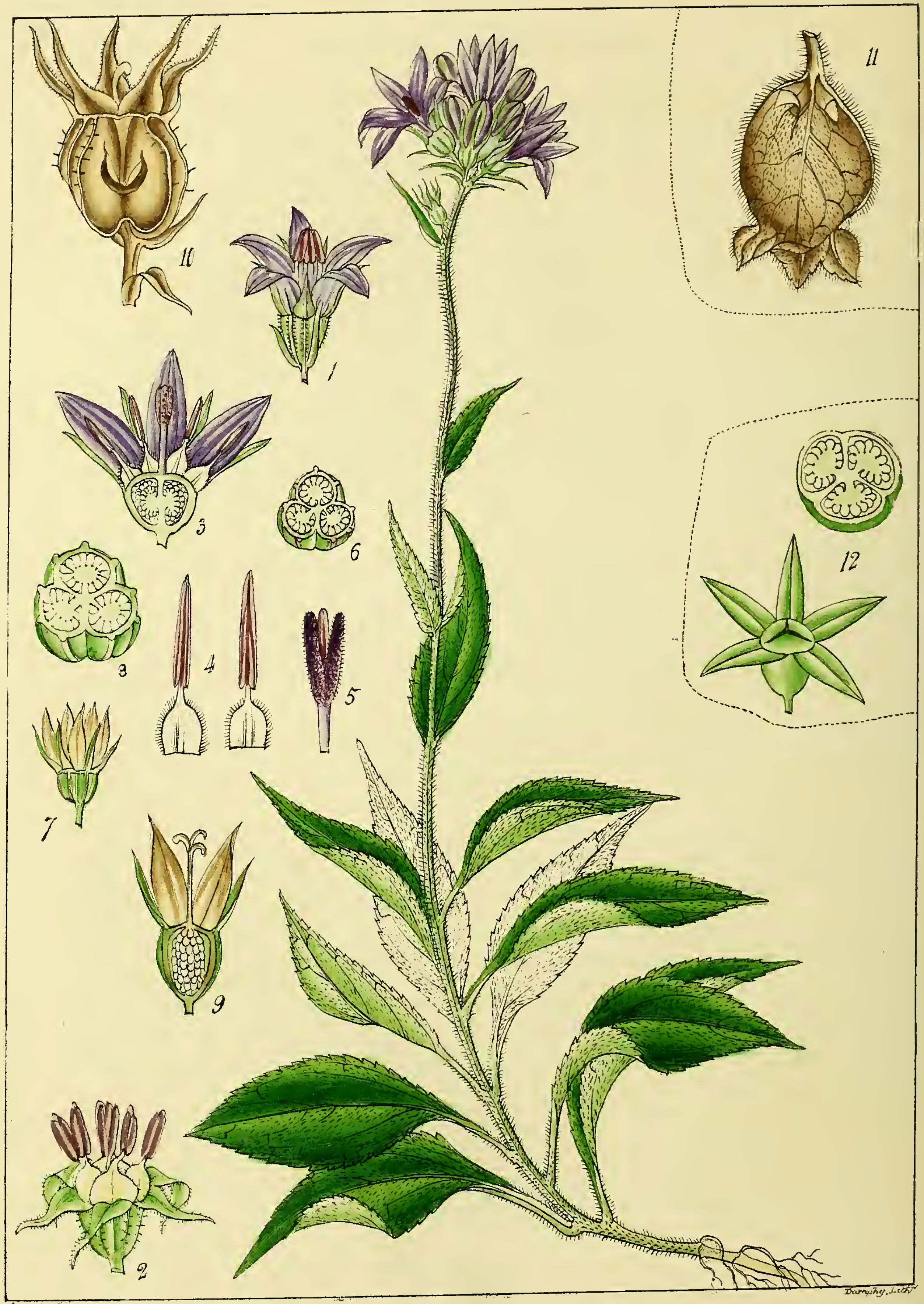
Affinities. Passing over the relationship of this family with the others referred to the class *Campanulineæ*, which scarcely require to be further insisted on, as they have been adverted to in the remarks on both the class and preceding order, I proceed to offer a few observations on more distant affinities. Assuming that the class forms a circle (but which requires to be verified), or group of orders which are really more nearly related to each other than to any others in the system, we may look round to see what others are most nearly related to it. Among these, the *Bicornes* (Ericales Lind.), through *Vacciniaceæ*, occupy a prominent place. It is true the bulk of that group have inferior flowers, but a similar structure is also occasionally found in true *Campanulineæ*, while the alternate leaves, plurilocular ovary, indefinite ovules, and albuminous seed, are common to both, as is, in many instances, the loculicidal dehiscence, to which *Vacciniaceæ* add epigynous insertion of the flowers. The *Caprifoliaceous* group, including *Rubiaceæ*, on the other side, presents many points of affinity in some of their genera, especially *Hedyotideæ*, which have valvate æstivation, and considerable similarity of habit, while others are widely distinct. *Compositæ* form a third allied group, but the almost uniform monospermous fruit, exalbuminous seed, and remarkable venation of the corolla, easily keep them distinct, equally from this as from all other families. Indeed, duly considering the importance of the differences in comparison with the points of affinity, the relationship of the Aggregatæ and Campanulinæ does not appear to me so near as most Botanists seem to view it. Some of the points on which considerable stress is laid, partaking probably more of the nature of analogies than affinities. These are all Epigynous groups, except *Bicornes* which forms the transition to the Hypogynous ones.

Geographical Distribution. This is a pre-eminently extra-tropical family, only about 30 out of 500 species being found within the tropics. They also prefer alpine regions, the greatest number of species being found in alpine countries: the Alps of Europe: the Caucassian, Altai, and Himalayan ranges, being all centres of habitation in the Northern hemisphere, while the Cape of Good Hope forms the principal one in the Southern. According to Alph. D. C., it is between the 36th and 47th degrees of Northern latitude the greatest number of species is found, and he considers the mountains just named as their true native country.

Properties and Uses. Under this head little can be said. The milky juice of some is acrid, but the opposite property is their predominating characteristic, and some few are used as food; none, I believe, are held in esteem in medicine. As ornamental plants many are in great request.

Remarks on Genera and Species. The flora of the Indian Peninsula affords but small scope for observations on this head, as about 7 or 8 species comprise the whole list. Of these, I have three referable to the genus *Wahlenbergia*, one of which was long referred to the order Rubiaceæ, under the name of *Dentilla erecta*, the other two are alpine plants, very nearly related, and both found on the Neilgherries.

Of *Campanula*, certainly three species are found on the Neilgherries, all of which are figured in the Icones. The one given here, seems to me a capitate variety of *C. fulgens*, rather than a distinct species, but being so different in appearance, I have thought it deserving of representation as well as the others. The accompanying analysis I have partly taken from other species. These two genera, *Campanula* and *Wahlenbergia*, are not easily distinguished, except when in fruit, the mature capsule supplying the essential distinguishing marks. In *Campanula*, the capsule opens by lateral pores or valves (see Figs. 10, 11, Plate 136), in *Wahlenbergia*, the dehiscence takes place on the apex (see Fig. 12, Plate 136), in other respects the structure of the two genera is very much alike. The position of the pores in the capsule of *Campanula* varies, and afford valuable sectional marks by which to group the numerous species of that genus. In some they are seated near the base, and in others near the apex (see Figs. 10, 11). In the former case the capsule is usually drooping, in the latter erect. The genus is further divided into sections and groups by certain appendages of the calyx, being present in one series and absent in another, by some having the capsule 5-celled, others 3-celled. With the aid of



CAMPANULA FULGENS (WALL.)

these sections almost every species of this large genus (containing about 200 species) can, for the most part, be readily made out.

EXPLANATION OF PLATE 136.

Campanula fulgens. Var. Capitula, flowering plant, natural size.
1. Detached flower and bract.
2. The same, corolla removed to show the insertion of the stamens and dilated base of their filaments.
3. A flower cut vertically, showing the relative position of all its parts.
4. Stamens, back and front views.
5. Upper half of the style and stigma, the latter covered with its spreading, rigid, collecting hairs.
6. Ovary cut transversely.
7. A capsule approaching maturity, with withered corolla still attached.
8. Cut transversely.
9. One cell opened vertically, style and stigma left to show the change of the latter after flowering.
10. A mature capsule after dehiscence.
11. Capsule of C. Alphonsii, after dehiscence.
12. Dehiscing capsule of *Wahlenbergia Indica.*

All more or less magnified.

XC.—GOODINOVIEÆ.

This family, according to De Candolle's Prodromus, includes about 130 species. Two or three only, so far as I am aware, have yet been found in India, and a few in the Moluccas, nearly all the rest being natives of New Holland and the Australian Islands. One is a native of the Cape, and a few of the Coast of South America. As an Indian family, it is one of very secondary note, but is interesting in connection with the geography of plants.

Character of the Order. Tube of the calyx more or less adherent to the ovary: limb 4–5-lobed, entire or obsolete, persistent. Corolla gamopetalous, more or less irregular, tube split above, rarely 5-partible; limb 5-parted, 2- or rarely 1-lipped, the middle lobes lanceolate, flat, the lateral ones thinner and more corolline; æstivation induplicate, rarely obsolete. Stamina united with the corolla, not with the style, alternate with its lobes; filaments distinct; anthers united or oftener free, continuous with the filaments, 2-celled, bursting longitudinally. Pollen simple or compound. Ovary 1–2- or 4-celled; ovules few or numerous. Style simple or rarely double. Stigma fleshy, surrounded with a cup-shaped membranaceous indusium, entire or 2-lobed, ciliate or naked. Fruit various, capsular, many-seeded with the septum, when present, usually parallel with the valves, or drupaceous, or nucamentaceous with definite seed. Seed erect, albuminous with a thick testa. Embryo straight, foliaceous; radicle inferior. Shrubby or herbaceous, not lactescent plants, variously hairy with alternate, exstipulate, simple, entire, dentate, or somewhat incised leaves. Flowers distinct.

Affinities. This family is nearly related to *Campanulaceæ* and *Lobeliaceæ* from which it principally differs in the curious cup-shaped indusium of the stigma, and the want of milky juice. Lindley formerly divided the order, as established by Brown, by the elevation of the sub-order Scævoleæ, to the rank of a distinct order, under the name of *Scævolaceæ*, a course in which he was not followed by any other Botanist, and which, on reconsideration, he has relinquished, as they are again united in his "Vegetable Kingdom." On the nature of the stigmatic indusium, which forms so important a feature in this family, considerable difference of opinion exists between Drs. Brown and Lindley. The former asks, "Is this remarkable covering of the stigma in these families merely a process of the apex of the style? or is it a part of distinct origin though intimately cohering with the pistillem? To the latter of these hypotheses he seems inclined to give the preference, viewing it, as I understand him, as composed of a series of modified stamina. Lindley, on the other hand, regards it "as nothing more than a remarkable prolongation of the rim which surrounds the stigmatic surface of Heathworts and of the plates which cover the style of Crane's bills (geraniums) and Balsams. It is in fact the upper free extremity of the carpillary leaves, distinct from that prolongation of the placenta, which is named the style and stigma." Between two such authorities, it would savour of presumption my attempting to decide, but for myself, I think the latter the more simple and probable of the two explanations of its origin. The æstivation in this family is also peculiar. The edges of

the petals are thinner than the middle, and in place of over-lapping each other or imbricating, they are folded inwards, so as, in the words of Dr. Lindley, "to assume the appearance of wings, belonging to a triangular back."

Geographical Distribution. Only one genus, Scævola, of 14 referred to the order, is found in India, the rest belong to the Eastern Islands, Australia, the Islands of the Southern Ocean, and Africa, and a few in tropical America. Of the 57 species, assigned to the genus Scævola, 3 are said to be found in India. I have not myself, however, met with more than 1, and that I have gathered in Ceylon, and on both the Coromandel and Malabar Coasts, and received specimens from the Tenasserim Coast. Of one D. C. adds, "Cor. ex Rheede intus tomentosa." This I find, as regards the tube, in specimens from both Maulmein and India, and it forms part of Roxburgh's description of *S. Taccada*, whence I suspect the *S. Bela Modagam* is really, as supposed by Roxburgh, identical with his plant, and that Southern India, in place of three, has but one species. Scind possesses another. Several of the species are widely distributed.

Properties and Uses. On this subject little is known. The leaves of *S. Taccada* are eaten by the natives. The Malays use the pith for making artificial flowers, &c., as the Hindoos use that of *Æschenomene aspera*, and Rheede states that the Malabar plant is used as an emollient to promote suppuration of boils and tumours.

Remarks on Genera and Species. Under this head I have but little to say. As already remarked, 3 species of *Scævola* are assigned by De Candolle to India, of these I only know one, that figured; whether the other two are varieties of it or destinct species, I am unable to say. The only other species, with which I am acquainted, is one from Scind, specimens of which were communicated by Mr. Stocks, of the Bombay Medical Establishment. So far as the character and description goes, it accords with *S. Plumieri*, but as there are others which it has, and which could scarcely have been overlooked if present in the plants described, I should not be surprised to find it prove a new species. The following extended specific character drawn up by Mr. Stocks, accompanied the specimens, which I insert, to enable Botanists, having specimens of the true plant, to compare and determine the identity or otherwise of the American and Scind plants. I give it under Mr. Stocks' name (though he does not now think it a new species) so that, should it prove new, he, as the discoverer, may have the honor of naming it. "Scævola uvifera (Stocks' MSS.), shrubby, glabrous, decumbent at the base, ramous, branches fleshy: axils nearly naked: leaves from oval to obovate, entire, succulent, narrowing towards the base into a short petiol: cymes axillary, about the length of the leaves, peduncles somewhat compressed: bracts linear, fleshy: limb of the calyx cup-shaped, entire or 5–6-crenate: lobes of the corolla fimbricated towards the base: stamens glabrous: anthers terminated by the inflexed apex of the connectivum: ovary marked with 10 coloured lines: drupe dark purple; putamen pyreform, 10-sulcated, rugous.

"Allied to S. Plumieri, if not indeed that plant. The hairs in the axils are scarcely visible with a lens. In size, shape, colour, bloom and consistence of the flesh, the fruit resembles a black grape."

I shall endeavour to find room for a figure of this plant in the Icones.

EXPLANATION OF PLATE 117.

1. *Scævola Taccada* (Roxb.), natural size.
2. Corolla detached and split open, to show the hairy tube and membranaceous margins of the lobes.
3. Ovary, calyx, stamens and pistil, showing the indusium of the style, within which the proper stigma lies concealed.
4. Detached stamens.
5. Ovary cut vertically.
6. —— cut transversely.
7. A detached nut splitting at the apex.
8. A seed cut vertically, showing the large embryo and sparing albumen.
9. Embryo detached.

Govindoo, del. Dunphy, Lith.

SCÆVOLA TACCADA (ROXB.)

XCI.—SPHENOCLEACEÆ.

This order, if such it be, rests on a single species, the well known Spenoclea Zeylanica, of Willdenow and Roxburgh, very common in moist, cultivated ground in this country. It is one of those out-lying plants that declines associating with any, as yet known, family, but which seems to approach *Campanulaceæ* more nearly than any other, wanting, however, several points, deemed essential in that family, which precludes its admission as a genuine member. Dr. Martius, who first indicated it as the type of an order, places it between Rubiaceæ and Campanulaceæ. Lindley, in the 2d edition of his Nat. System, adopted it as a sub-order of *Campanulaceæ*, in which he was followed by Endlicher. Meisner and De Candolle adopt the order, the latter placing it at some distance from the Campanulaceous orders; and lastly Lindley, in his Vegetable Kingdom, has, for the present, reduced it, placing the genus with two others as "anomalous genera" at the end of his Campanulaceæ, waiting the discovery of companions better suited to indicate its true station.

Amidst such diversity of opinion, among the lights of the science, I do not feel myself competent to arbitrate, but at the same time, considering that the readers of this work should be put in possession of all the information I can furnish on such litigated questions, I, for the present, adopt the views of Martius and De Candolle, as affording an opportunity of furnishing a figure and description of a plant which has provided materials for so much difference of opinion. My own opinion, so far as my imperfect acquaintance with Campanulaceæ justifies me in expressing it, is in favour of separation. The deciduous corolla, the insertion of the stamens on its tube, not on the calyx, the short styles, and capitate stigmas, without collecting hairs; the central, pendulous, fungoid placentæ, circumscissile dehiscence, and, above all, the very sparingly albumenous or almost exalbumenous seed; form such a combination of characters, as leave no room to doubt the propriety of keeping this genus altogether distinct, rather than placing it at the tail of another order, waiting the discovery of companions, as, in that situation, its peculiarities may not be so clearly brought to light. De Candolle thus defines the order, with the exception of one or two slight modifications I have introduced.

Character of the Order. Tube of the calyx adnate to the ovary, limb 5-parted, lobes round on the margin, inflexed, persistent, finally connivent over the ovary. Corolla deciduous, 5-parted, lobes inflexed. Stamens 5, sub-sessile on the sinuses of the corolla; anthers roundish, 2-celled, dehiscing longitudinally. Ovary 2-celled, many-ovuled. Styles very short, stigma capitate, bilobate, glabrous. Capsule membranaceous, 2-celled, cuniform at the base, many-seeded, circumscissile. Placentæ fungose, pendulous from the apex of the septum. Seed tuberculate, minute, terete, sparingly furnished with fleshy albumen. Embryo straight, terete, radicle about twice as long as the cotyledons.—Herbaceous, erect, ramous, glabrous, annuals. Leaves alternate, lanceolate, exstipulate, entire. Spikes terminal or leaf opposed, peduncled, cylindrical. Bracts 3 or 3-partite under the flower. Flowers small, white.

Affinities. On this head I have nothing to offer. That this family, if such it be, is nearly allied to *Campanulaceæ*, seems certain, but that it does not belong to it is admitted on all hands. The placentæ are curious, two spongy, egg-shaped bodies, pendulous from the apex of the septum. My dissections of the seed tend to confirm Gærtner's description of its structure, as I find the embryo enclosed in a thin, fleshy albumen and very delicate, translucent, tuberculed testa.

Geographical Distribution. So far as yet known, this order rests on a solitary species, found growing in wet or marshy soils, in India, Ceylon, Eastern Islands, Egypt, Mexico and the West Indies; thus, like other aquatic and sub-aquatic plants, enjoying a very extended geographical distribution.

Properties. Unknown.

EXPLANATION OF PLATE 138.

Sphenoclea pongatium (D. C.) Natural size.

1. An unopened flower.

2. A flower further advanced with its bract and bracteoles.

3. A flower freely expanded, but the relative position of its parts not accurately preserved, the lobes of the corolla being placed too nearly opposite the lobes of the calyx.

4. A corolla detached, and 5. Split open, showing the insertion of the stamens.

6. Detached stamens, back and front views.

7. Capsule, enclosed in the persistent calyx.

8. Calyx opened to show the line of dehiscence of the circumscissile capsule.

—— Unnumbered figure beside the anthers—top of the capsule seen from within.

9. Capsule transversely, two-celled.

10. An old capsule, after shedding its seed, showing the remains of the spongy, pendulous placentæ.

11. A seed. 12. Cut vertically, showing the embryo in situ.

13. Embryo detached.

XCII.—VACCINIACEÆ.

This is a beautiful family, including upwards of 200 species of shrubby or arboreous plants. They are for the most part extra-tropical; those found within the tropics being natives of alpine regions, where elevation compensates for the lower temperature of higher latitudes. In Southern India three or four species only have been detected, but it seems probable more will yet be found when we are better acquainted with their distinguishing characters. Three are natives of the Neilgherries; one, perhaps distinct, is found on the Shervaroys, near Salem, and another, but not distinct from one of the Neilgherry ones, on the Pulney Hills. The same may be said of one found in Ceylon. On the Khassya Mountains, bordering Upper Assam, they are numerous, and there, the late Mr. Griffith wrote me, several of them are parasitical—a peculiarity one, only acquainted with the terrestrial forms, could scarcely anticipate; but perhaps he meant epiphytical.

Character of the Order. Calyx superior, entire, or with from 4 to 6 lobes. Corolla imbricated in æstivation, monopetalous, lobed as often as the calyx. Stamens distinct, double the number of the lobes of the corolla, inserted into an epigynous disk; anthers with two horns and two cells, bursting by pores. Ovary inferior, 4- to 10-celled; style simple; stigma simple. Berry crowned by the persistent limb of the calyx, succulent, 4–10-celled; cells 1- or many-seeded. Seeds minute, pendulous when solitary; embryo straight, in the axis of a fleshy albumen; cotyledons very short; radicle long, inferior. Much branched, shrubs or trees, frequently evergreen, and occasionally epiphytes. Leaves alternate, undivided, without stipules, often with glandular notches. Flowers solitary or in racemes. Lindley.

Affinities. On this head there is considerable diversity of opinion, some Botanists, among whom Endlicher now takes the lead, uniting this order and *Ericaceæ*, others, and they forming the majority, considering the two families distinct, but so closely related, that they are always placed next each other, under the impression that the distinguishing features, the adherent ovary of the one, and the free one of the other, do not afford ground for a wider separation. Dr. Lindley, however, has recently taken a different view, and widely separated them by placing the one in his Hypogynous class, and the other in his Epigynous, with the whole of the Perigynous one interposed. He considers them more nearly allied to *Cinchonaceæ* than *Ericaceæ*, an arrangement in which, I apprehend, he will find but few followers. For myself, I feel disposed to coincide with Endlicher, from viewing the adherence, or non-adherence of the calyx, when placed in opposition to such striking peculiarities as those which unite these two families, as of secondary value, and one which, in such a case, ought not to be so strongly insisted on. The distinguishing feature of both orders is found in the curious, nay, unique structure of the anthers, common to both, but not elsewhere observed, and which, as will be seen on reference to the accompanying plates, is very remarkable.

Apart from that character, there can scarcely be a doubt that *Vacciniaceæ* are very nearly related to both *Caprifoliaceæ* and *Cinchonaceæ*, and may be viewed as their representatives in the Hypogynous sub-class. *Ericaceæ*, in like manner, though a Hypogynous family, becomes

SPHENOCLEA PONGATIUM (D.C.)

connected with the Campanulaceous group, through *Lobeliaceæ* (some of whose species have at least semi-superior ovaries), on the one side, and *Vacciniaceæ* on the other. Endlicher seems to take a different view of their affinities, as, in place of adopting the usual course, and placing them beside Campanal and Cinchonal groups, he removes them to the end of his monopetalous division, and stations them next Umbelliferæ, the first of his polypetalous orders. The advantage of this disposal I cannot trace, as he seems thereby to separate them from all those families to which all other Botanists consider them most nearly related.

Among the Polypetalous groups, Lindley indicates *Escalloniaceæ* as the nearest relation of *Vacciniaceæ*, and *Rubiaceæ* and *Dilleniaceæ* as those occupying the same station towards *Ericaceæ*.

Geographical Distribution. As already stated, this is an extra-tropical family, and most abounds in Europe and North America, also in Northern Asia. Many, however, are natives of the Andes of Peru, and it is probable some few extend southwards to those of Chili, but up to the present time, it is said, none have been found beyond the tropic of Capricorn. Two, however, are recorded from New Caledonia, lying under or rather to the south of that line. In Southern Asia, they extend from the Northern tropic to Ceylon, and I have published one (Icones 1186), from Malacca. On the slopes of the Himalayas, and the off-shoots of that range, extending through Khassya and Bootan, they are numerous, but always occupying stations at a considerable elevation above the sea. A truly tropical species has not yet, so far as I am aware, been found.

Properties and Uses. Even in those countries where they abound, these are of no great value. The bark and leaves are astringent and tonic. The berries of several are agreeably acid, and in Northern Europe and America are much used as tart-fruit, and those found on the Neilgherries form no bad substitute, except in so far as a considerable dash of bitterness is combined with the acid. The people of Pasta in Peru make wine from the fruit of *Thibaudia (Vaccinum) macrophylla*, *&c.* Nothing is known regarding the properties of the Indian species beyond the fact of their being, on their native mountains, exceedingly ornamental trees and shrubs, which will not thrive on the plains on account of the high temperature.

Remarks on Genera and Species. Under this head much might be said, as it appears to me the genera have been either most unduly multiplied or so loosely constructed, as regards characters, that it seems, as they now stand in De Candolle's Prodromus, impossible to determine whether a new species should be referred to *Gaylussacia*, *Thibaudia*, *Agapetes*, *Caratostoma* or *Vaccinium*. I was led to this conclusion from the examination of about 30 species, derived from Europe, Asia and America, which I was under the necessity of entering upon, to enable me to refer about 20 Indian species, of several of which I had prepared drawings for publication, to their proper genera. The flowers and ovary of every species were carefully dissected and compared with the characters of the several genera named above, and the only conclusion at which I could arrive was, that they all belonged to one genus, unless it might be considered desirable to divide them into more, from characters taken from the number and forms of parts of the flower, the horns of the anthers, &c. These last, however, I only deem of specific or at best sectional value. Representations of several of them will be found in plate 141, D.

Having concluded this examination, I ventured to reconstruct the generic character of *Vaccinium*, which I published, with some general remarks on the genera of the order, in my Icones, and which, as I have not since found occasion to alter, I shall introduce here, only slightly modified in the arrangement. It may, however, be well to suggest, for the consideration of those who have tetramerous species, to inquire whether they might not be separated, to form the type of a genus, or at all events a sub-genus. The only one I have examined, *Gaylussacia dependens*, seems sufficiently distinct to justify the latter, if not the former proceeding.

VACCINIUM.

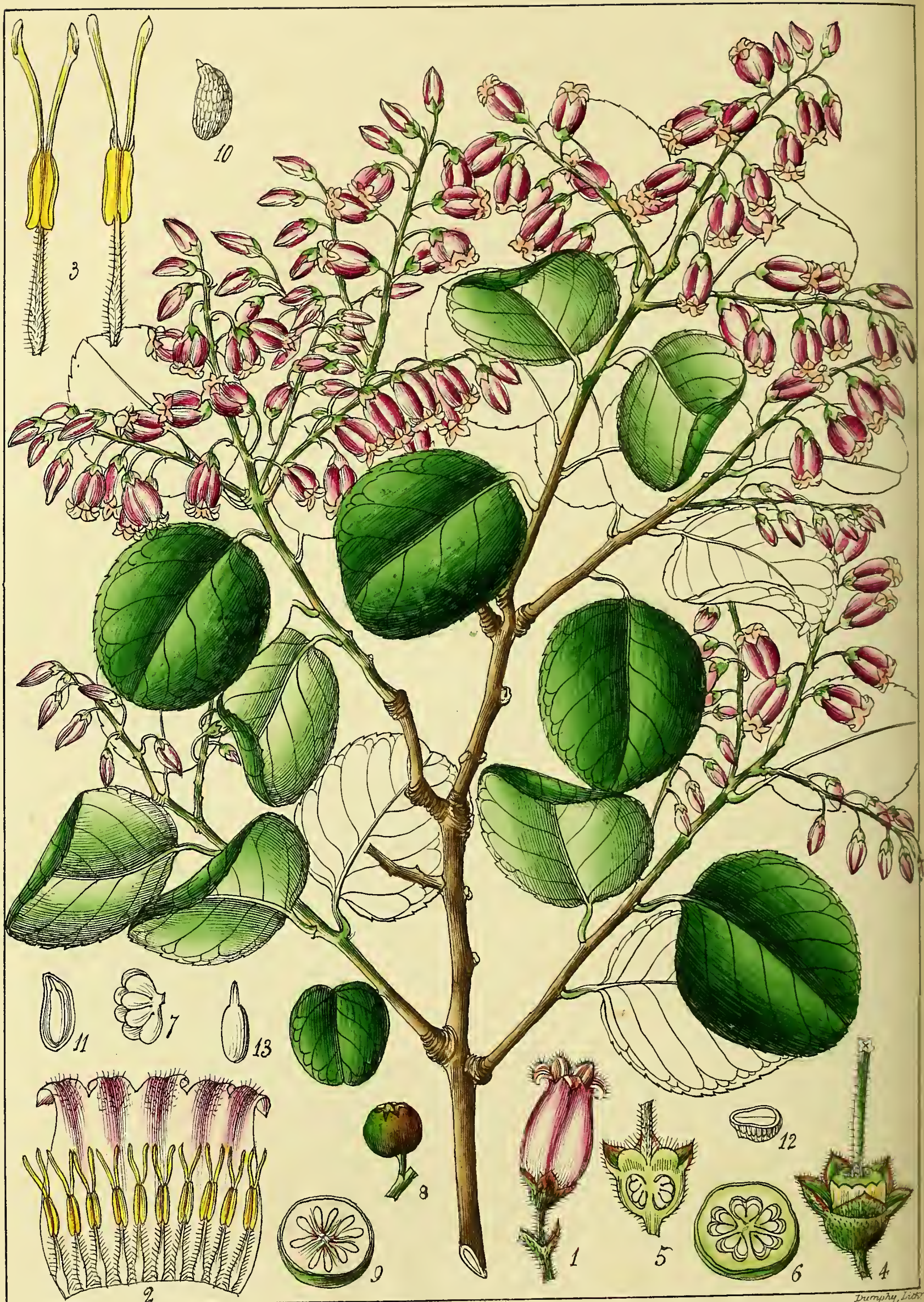
Calyx adherent, limb 4–5-lobed. Corolla tubular, 4–5-cleft. Stamens 8–10, epigynous, anthers adnate, 2-celled, often furnished with 2 bristles on the back, the cells ending in a tube open at the apex. Ovary 4–5-celled, placentas ascending, usually bearing the ovules on the margin. Berry 4–5-celled, often spuriously 10-celled, through the adherence of the walls to the thickened placentas. Seed several in each cell, testa coriaceous or somewhat bony: albumen fleshy: embryo orthotropous, radicle next the hilum. Trees, shrubs, &c.

According to this character, it is of no moment whether the lobes of the calyx are large or small, whether the corolla is long or short, thick or thin: the anthers may or may not be bristled, but are always expected to have the cells more or less prolonged into tubes, and to have the number of cells of the ovary equal to those of the lobes of the calyx and corolla, with, more or less distinctly, free ascending placentas and a plurality of ovules. Such is the genus *Vaccinium*, as understood by me, when naming the following and several other still unpublished species in my Herbarium.

Dunal, in his monograph of the order *Vacciniaceæ*, retains *Agapetes* and *Thibaudia;* Endlicher, Miesner and Lindley unite them. Kunth is followed by Miesner, in expressing a doubt as to whether *Ceratostema* is distinct from *Thibaudia*, and Hooker states that he "cannot understand what are the essential distinguishing marks between them." Among the following are species which have been referred by different Botanists to *Ceratostema*, *Agapetes*, *Thibaudia*, *Gaylussacia* and *Vaccinium.* To determine among so many genera, it became indispensable to examine the characters of all with much care. After the closest scrutiny and careful dissection of the flowers of all the Indian species in my collection, side by side with several acknowledged *Vaccinia* from both America and Europe, I found it utterly impossible, from the characters given, to make out more than one genus among the Asiatic ones, the structure being the same in all. By Roxburgh these would, perhaps, have been all referred to *Ceratostema:* Wallich refers them to *Thibaudia*, while Don and Dunal form the genus *Agapetes* for their reception. Had long tubular flowers been a constant feature, I might on that account, aided by geographical distribution, have followed these authors, and, assuming that as its essential character, kept up their genus. This, however, is far from being the case, and is therefore, as a generic character, useless. And on turning to Dunal's character of *Vaccinium*, I find the corolla described as "campanulata, urceolata vel cylindrica."

In all the Indian ones it is either urceolate or cylindrical. He describes the stamens as "limbo calycis inserta," which is the case in all the Indian ones I have examined, and the fruit "Bacca calyce vestita globosa 4 aut 5 locularis loculis polyspermis, rarissime 10 locularis loculis monospermis" which, except the last clause, is equally applicable to the fruit of all I have had an opportunity of examining. The ovary, unfortunately, is not referred to in the character of either genus. The concluding clause of the character may, perhaps, account for Professor Lindley's referring one of the species to *Gaylussacia*, which, while that clause remains as part of the character of *Vaccinium*, seems scarcely a distinct genus, the fruit having 10 cells with 1 seed in each being its essentially distinguishing mark. In all other points Dunal's characters of the 2 genera are nearly word for word the same, and the abortion of all the ovules but 2 in each of the 5 cells converts *Vaccinium* into *Gaylussacia* and, unless care is bestowed in the examination, even that is not necessary, as a transverse section of a nearly mature fruit almost always presents the appearance of 10 cells with one seed in each, and I feel nearly certain that an examination of the *ovary* will show that but few of Dunal's 29 species have it 10-celled with a single ovule in each. *G. dependens*, an authentic specimen of which was most obligingly communicated to me by Mr. Gardner of Ceylon, has a 4-celled ovary, with numerous ovules, and is in fact a species of *Vaccinium* with very short anther tubes.

Whether *Ceratostema* can be kept distinct I am unable to say, but judging from the really essential points of the character, apart from the numerous non-essential ones introduced by Dunal, I think not. *Thibaudia* has one good distinguishing mark in the union of the filaments between themselves, and their attachment to the base of the corolla. But if that is to be taken



Govindoo, del. Dumphy, Lith.

VACCINIUM ROTUNDIFOLIUM (R.W.)

as the essential character of the genus, then both *Macleanea* and *Anthopterus* should be associated as sub-genera, the collateral marks, derived from the calyx and corolla, being scarcely of generic value in a family where these organs are so variable.

Influenced by such considerations, I have, without hesitation, referred all the Indian species to *Vaccinium*, with the sub-generic appellation *Agapetes* to mark their Asiatic origin, thus:—

Vaccinium (A) Leschenaultii (R. W. *V. arboreum*, Lesch. not Michx. *Agapetes arborea*, Dun. in D. C. Prod. *Andromeda symplocifolia*, Wall. L. No. 1522), arboreous, older branches glabrous, greyish white, ramuli pubescenti-villous: leaves shortly petioled, ovato-elliptic, serrated, acute, paler beneath, hairy on the costa: racemes axillary and terminal, about the length of the leaves.

Neilgherries, frequent, flowering March and April, but usually to be met with, in different situations, in flower and fruit at all seasons. The berries, which are about the size of red currants, are agreeably acid, and make excellent tarts, much resembling in taste those made with the cranberryus. *Oxycoc palustris* or *O. macrocarpus*.

1189. Vaccinium (A) Neilgherrense (R. W.), shrubby, glabrous, except the pubescent young shoots and leaves: leaves lanceolate, acute at the base, acuminate at the point, racemes longer than the leaves, axillary, usually confined to the extremities of the branches: flowers whitish or rose coloured, short, pedicelled, usually furnished with a large foliaceous bractea: corolla ovate, slightly pubescent: filaments hairy, anthers bristled, tubes dilated towards the apex.

On the low banks of streams, Neilgherries: abundant along the banks of the Pycarrah river for a mile or two above and below the Bungalow. Flowering during the dry season, from February till April. It is nearly allied by its technical characters to the former, but is evidently quite distinct. The large, foliaceous bracts, supplies the best distinguishing mark, but both in habit and locality it differs. Flowers usually white and smaller than those of the preceding, smaller even than those of the specimen selected for representation.

3. Vaccinium (A) rotundifolium (R. W.), arboreous, glabrous, or with the ramuli slightly pubescent: leaves orbicular, coriaceous, entire or slightly crenulato-serrate, glabrous, racemes axillary and terminal, longer than the leaves: flowers urceolate, 5-lobed: filaments filiform, hairy: bristles of the anthers minute or wanting.—A small, very ramous tree. Leaves deep green above, paler beneath. Flowers pale pink, often streaked with darker lines, lobes of the corolla hairy. Berries about the size of a large currant, purplish red when ripe. Testa of the seed reticulate.

I have only met with two or three trees of this species, growing in a clump of jungle, behind Kelso Cottage.

EXPLANATION OF PLATE 139.

Vaccinium rotundifolium. Flowering branch, natural size.

1. Detached flower, with its bract.
2. Corolla split open, showing the stamens.
3. Detached stamen, back and front views.
4. Calyx, ovary, and style, showing the prominent, fleshy disk.
5. The same cut vertically.
6. Ovary cut transversely, 5-celled, with two rows of superposed ovules in each.
7. Placenta with its ovules.
8. A mature berry.
9. The same cut transversely.
10. A seed. 11. Cut longitudinally, and 12. Transversely.
13. Embryo detached.

EXPLANATION OF PLATE 141. D.

Back and front views of anthers of

1. Vaccinium Wallichianum, exaristate.
2. Vaccinium serpens, exaristate, spurred.
3. Vaccinium venosum, cells large, sub-calcarate.
4. V. odontocerum, horns aristate.
5. V. Dunalianum, aristate, filament short, dilated.
6. V. Leschenaultii, anthers aristate, filaments ventricose.
7. V. Griffithianum, aristæ large, hairy.

For figures of these species, see Icones Plant. Ind. Orientalis.

CXIII.—ERICACEÆ.

This large and beautiful family agrees in so many particulars with the preceding, and so much has been said regarding it under that head, that little remains to be added. They agree in similarity of habit, and inflorescence, in the form of their flowers, and structure of their anthers and seed, and with some modifications in their geographical distribution. They differ, however, in the position of their ovary, in relation to the other parts of the flower, and in having a capsular, dehiscent fruit, in place of a baccate and indehiscent one.

These differences are far from unimportant, and suggest the question, Ought they to have ordinal value assigned to them? Endlicher, no mean authority, replies in the negative, and

groups both under one name; but most other Botanists seem to think otherwise, and keep them distinct. One advantage certainly attends their separation, it gives greater precision to the characters of both orders, without any resulting inconvenience, so long as they are kept together. The same rules apply to the disposition of orders in the general system, as to genera in an order; and as examples are not wanting of hypogynous and epigynous genera meeting in the same order, so neither should an epigynous group of genera, so intimately related to a hypogynous order that there is no other line of separation, be denied the same indulgence. Analogy, therefore, is in favour of Endlicher's arrangement and, as already remarked, I coincide with him, in such a case, in attaching but secondary value to the extension of the calyx tube, and its cohesion to the ovary, and therefore esteem it a matter of no moment, whether we view these two groups as one order, composed of two sub-orders, or as two adjoining orders, but I cannot yet approve of their separation on such grounds as those adduced by Dr. Lindley.

Character of the Order. Calyx 4–5-cleft, nearly equal, inferior, persistent. Corolla hypogynous, monopetalous, 4–5-cleft, occasionally separable into 4–5 pieces, regular or irregular, often withering, with an imbricated æstivation. Stamens definite, equal in number to the segments of the corolla, or twice as many hypogynous, or scarcely inserted into the base of the corolla; anthers 2-celled, the cells hard and dry, separate either at the apex or base, where they are furnished with some kind of appendage, and dehiscing by a pore. Ovary surrounded at the base by a disk, or secreting scales; many-celled, many-seeded; style one, straight; stigma 1, undivided or toothed, or 3-cleft, with an indication of an indusium. Fruit capsular, many-celled, with central placentæ; dehiscence various. Seeds indefinite, minute; testa firmly adhering to the kernel; embryo cylindrical in the axis of fleshy albumen; radicle much longer than the cotyledons, and next the hilum.—Shrubs or under-shrubs. Leaves evergreen, rigid, entire, whorled or opposite, without stipules. Inflorescence variable, the pedicels generally bracteate. Lindley.

Affinities. Since the publication of Jussieu's Genera Plantarum, most of the leading adherents of the Natural System of Botany have, certainly not without an occasional demur, adopted his views, in assigning a higher value to the varying forms of the corolla, than to the point of its insertion. His primary divisions, *Acotyledons*, *Mono*, and *Di-cotyledons*, being based on physiological distinctions, are universally admitted to be of a higher order than his secondary ones, *Apetalous*, *Mono*, and *Polypetalous*, which are structural, and therefore liable to variation. Dr. Lindley, in his "Vegetable Kingdom," moots the question, Whether these or the tertiary series, *Hypogynous*, *Perigynous*, and *Epigynous*, ought to have the higher value assigned. Jussieu, it is evident, from his having given Form the second, and Insertion the third place in his "Method," attached the higher value to Form. De Candolle and Lindley advocate the opposite view, giving the preference to Insertion. I do not consider myself competent to decide between such high authorities, but think much may be said on both sides. Both are structural characters, and both liable to variation, and inconstancy in the same families, or even among species of the same genera, while in some, it is hard to say, whether the insertion is Hypogynous or Perigynous, an example of which is furnished by the order under consideration; Jussieu, De Candolle and others, viewing it as Perigynous, Lindley as Hypogynous, while the very nearly allied order, or indeed, according to some, sub-order or section, *Vacciniaceæ* is Epigynous: a sub-class, by the way, with which De Candolle nominally dispenses as not being sufficiently distinct from the perigynous, which, however, he divides into two sections, Calyciflore and Corolliflore, nearly equivalent to the older divisions.

Keeping these facts in view, it seems difficult to determine what advantage is gained by the change, beyond showing that both foundations are artificial, and that according as we build on the one or other, we establish a distinct and remote series of affinities, probably both equally convenient in practice, and both equally wide of the truth. Jussieu, adopting the form of the corolla as the basis of his arrangement, places Ericaceæ in the middle of the group of monopetalous orders; while Lindley, adopting the point of insertion of the stamens as the basis of his, places the Erical alliance in the midst of a long series of polypetalous ones. The question now to be

answered is, Which is the best? Is the Erical alliance more naturally situated when associated with Ranales, Berberales, Rutales, Gereniales, &c., than it would be if associated with Echiales, Bignoniales, Campanales, Cinchonales, &c.? This question must be answered by better and more philosophical Botanists than I presume to consider myself; but, so far as my own opinion goes, I own that I prefer the old place, from thinking the Erical alliance more nearly related to the Cinchonal and Campanal alliances, than to the Rutal and Berberal. But while I thus adhere to the older arrangement, perhaps more from habit than philosophy, I still think we are greatly indebted to Dr. Lindley for striking out a new path to aid us in arriving at a correct knowledge of affinities, as it may prove the means of leading us to the discovery of many interesting relationships, hitherto overlooked, owing to our having had only one road by which to arrive at them, as, by showing us the same things in different lights and combinations, it may ere long be the means of indicating other paths, leading more directly to the still distant object in view, an arrangement of orders built on a natural, not artificial foundation, or in other words, on a physiological, in place of a structural basis. Should we ever attain that point of perfection, we may then expect to see all variations of structure combined in our family groups, by whatever name designated, cohorts, alliances, classes, or all combined, as so many parts of the general plan of arrangement. *Cinchonaceæ* may be quoted as a case in point, where a very heterogeneous combination of structural forms is held together by a single physiological character.

Geographical Distribution. The range of this family is extensive. As a whole, it may truly be called Cosmopolite, not so its sections. *Ericeæ*, including all the true heaths with marcescent corollas, are confined to Europe and Africa, especially the Southern promentory of the latter; "Cape Heaths" are proverbial. In Europe, though the number of species is small, the individuals are unlimited, extensive tracts of country being occupied by them, to the almost total exclusion of all other plants, except some grasses, rushes, &c. *Andromideæ*, on the other hand, distinguished by their deciduous flowers, are common to Europe, Asia, Africa, North and South America, and a few in Australia; but I believe in all these countries showing, when growing within the tropics, an extra-tropical habit, by selecting the more elevated regions as their place of abode.

In India, the Himalayas, and their off-shoots in Assam, Khassya, &c., furnish several species of Andromida, Gaultherea, and Rhododendron. The Neilgherries furnish one species of each of the two last named genera, and Ceylon an equal number, perhaps more. Of the nearly allied order, Epacrideæ, Malacca furnishes one species, forming a connecting link between the Floras of the two countries, New Holland being truly the native country of that family, which there occupies the place the heath does in Africa.

Medical Properties. This family is much more celebrated for its ornamental, than economical or medicinal properties, though not altogether deficient in these. In its ornamental capacity, it is nearly unrivaled in the Vegetable Kingdom. The true heaths are universal favourites in the green house, the *Andromedas* are about equally esteemed in the parterre, and the rich *Rhododendrons*, *Azalias*, and *Kalmeas*, in the shrubbery. In regard to their economical applications, little can be said for them. Among the *Ericeæ*, or true heaths, *Caluna vulgaris*, common Heather, is employed by fullers and dyers, while its tough branches are in universal demand for brooms, &c., it possesses considerable astringency and, where abundant, is a favourite food for bees, of which last property several species of *Erica* partake. The *Andromedeæ* are endowed with bitter and astringent properties, combined in some with resinous and aromatic virtues, while the *Arctostaphilos Uva ursi*, has been long celebrated for its efficacy in the relief of renal diseases and other affections of the urinary passages. Its berries are austere and mealy, but those of some of the other species are said to be pleasant and edible. Some possess narcotic virtues in a mild form. The fruit of *Gaultherea procumbens*, an American shrub, contains a pungent volatile oil, used as an anti-spasmodic and diuretic. That of the Neilgherry species is, on the contrary, the most mawkish, insipid fruit I almost ever recollect tasting. Among the *Rhodoreæ*, narcotic properties of much intensity exist, which have been found useful in the treatment of Nervous diseases and Chronic Rheumatism. And the often-quoted case of poisoning, during the retreat of the 10,000 Greeks, is attributed to eating honey

obtained from either *R. ponticum* or *Azalea pontica.* On the Himalayas, we are informed by Dr. Royle, the flowers of *Rhododendron arboreum* are eaten by the hill people, and made into Jelly by Europeans, neither of which useful applications has yet extended to the Neilgherries, the flowers there being allowed to bloom and fade unharmed by man, unless when added to a bouquet. Neither is the timber employed on the Neilgherries, probably owing to its seldom attaining sufficient capacity, the tree there being generally stunted in its growth. In the Upper Provinces the same high authority informs us the powdered leaves of *R. campanulatum* is used as snuff, and that the leaves of *R. lepidotum* are aromatic and stimulant.

Remarks on Genera and Species. My acquaintance with the order is too limited to admit of my saying much under this head. The old genus *Erica* has been, by Mr. Bentham, retained in nearly its original integrity, and includes 429 species. The genus *Andromeda* was largely sub-divided by the late Mr. Don and others, many of whose genera have been retained by De Candolle. Endlicher has viewed the matter in a different light, and again reduced many of these. The few Indian ones I have examined lead me to adopt his views in regard to Don's genus *Picris*, which I have restored to *Andromeda* in the Icones, Nos. 1198, 9, and 1200.

The order very naturally divides itself into 4 sub-orders or tribes, so far differing in habit as to be easily recognized, namely:

I. Abuteæ. Corolla deciduous: fruit berried, indehiscent.

II. Andromedeæ. Corolla deciduous: fruit capsular, opening along the middle of the cells (loculicidal): buds scaly.

III. Ericeæ. Corolla withering (not deciduous): fruit capsular, loculicidal, or rarely septicidal; buds without scales.

IV. Rhodoreæ. Corolla deciduous, often deeply cleft: fruit capsular, spliting along the partitions (septicidal), flower-buds usually scaly.

The two Neilgherry species belong respectively to the 2d and 4th of these groups, *Gaultherea* being Andromedeous, and Rhododendron, Rhodoreous.

The ovary of Rhododendron presents a peculiarity of structure I have not observed elsewhere, nor seen noticed by any of the writers I have at hand to consult. The placentiferous margins of the carpillary leaves are acutely inflexed, and do not coalesce in the usual way to form a single axillary placenta, but remain distinct, though in close apposition, bearing the placenta and ovules on the back, or under surface of the leaf! the upper one being considered the normal position. This curious structure I have attempted to show in Figures 9 and 10, Plate 141. In this genus the stamens are, for the most part, twice as many as the cells of the ovary, in some they are equal, but in one, which I published (Icones, No. 1203), they are in the proportion of 15 to 10, that is, 15 stamens to 10 cells. The relation existing between the number of stamens and cells of the ovary in this genus seems to merit further investigation.

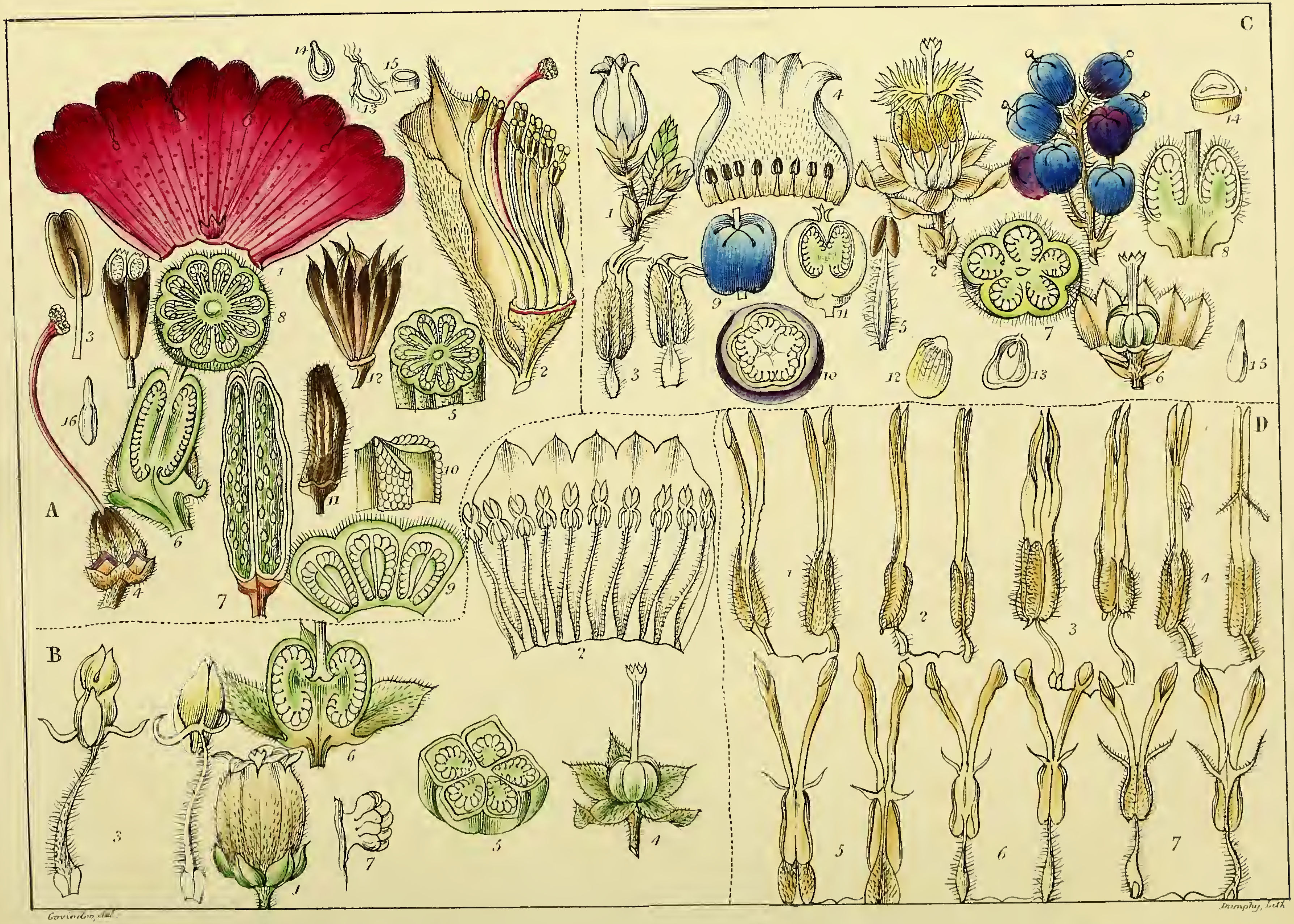
Andromeda and *Gaultheria* are both fully analyzed, B. and C. Plate 141, where it will be seen that the principal difference between them consists in the calyx of the latter becoming succulent, berry-like, while that of the other does not; it seems to form the transition from *Arbuteæ* to *Andromedeæ.*

EXPLANATION OF PLATE 140.

Rhododendron arboreum. Flowering branch a little reduced, the detached leaf natural size. The drawing is taken from a Himalayan specimen. It differs from the Neilgherry plant in having the under surface of the leaves covered with whitish, farinaceous tomentum, that in the Neilgherry plant being of a brownish, rusty colour, hence it is conjectured they are distinct species, and that the names which have been respectively assigned to them *R. arboreum,* for the Himalayan tree, and *R. nobile,* for the Neilgherry one, ought to be retained.

Govindoo, del. Dunphy, Lith.

RHODODENDRON ARBORCUM (SM.)



A. RHODODENDRON B. ANDROMEDA C. GAULTHERIA D. VACCINIUM.

EXPLANATION OF PLATE 141.

A.

Rhododendron arboreum (Neilgherry tree).

1. Corolla detached and split open.
2. Stamens, ovary, style and stigma, with the attached bract.
3. Anthers, back and front views.
4. Ovary, and style, and stigma, with the calyx.
5. Ovary cut transversely, 10-celled.
6. Ovary cut vertically.
7. Ovary about half-grown, portion of the pericarp removed to show the seed in situ.
8. One about the same age cut transversely.
9. Three detached carpels more highly magnified, to show the inflexion of the carpillary leaves, the inflexed portions slightly separated by art.
10. A small portion of a carpel detached, the two placentæ fully separated. This was a difficult dissection, and not perhaps so clearly shown as it might have been.
11. A nearly mature fruit, a little reduced.
12. A capsule after dehiscence and shedding of the seed.

13, 14, 15. A dissected seed, showing the embryo surrounded by albumen, but on too small a scale to show clearly the parts.

16. Detached embryo.

With the exceptions mentioned, all more or less magnified.

B.

Andromeda lanceolata.

1. Detached flower.
2. Corolla split open, showing the stamens adherent to the extreme base.
3. Detached stamens, back and front views.
4. Calyx, ovary, style and stigma.
5. Ovary cut transversely.
6. Cut vertically.
7. Placenta and ovules detached.

C.

Gaultheria Leschenaultii.

1. Portion of a raceme with open flower and flower-bud.
2. Flower, corolla romoved, showing the calyx and stamens in situ.
3. Detached fertile stamens, back and front views.
4. Corolla of a female flower laid open, showing the sterile stamens adherent to its base.
5. A detached sterile stamen.
6. Ovary, style, and stigma, with the calyx and bracteols.
7. Ovary cut transversely.
8. Cut vertically, showing the ascending direction of the placentæ.
9. A fruit full grown.
10. —— cut transversely.
11. —— cut vertically, showing very distinctly the succulent calyx.
12. A seed, testa reticulate.
13. —— half the testa removed, to show the kernel in situ.
14. Seed cut transversely, showing the embryo inclosed in albumen.
15. Embryo detached.

All more or less magnified.

It appears from the above analysis that Gaultheria occasionally shows a tendency to become polygamous through the partial abortion of the stamens. The character of the appendage of the anthers of this species is very distinct from that of *Andromeda,* and if constant throughout the genus would always supply an excellent and easily observed generic character.

D.

For explanations of this section, see Vacciniaceæ.

COROLLIFLORÆ.

Calyx gamosepalous, that is, the sepals more or less united. Petals for the most part united, distinct from the calyx at the base. Stamens usually adnate to the corolla. Ovary for the most part free, rarely adnate to the calyx. D. C.

Before proceeding to the examination of the individual families of this large class, a few introductory remarks on their general arrangement and grouping, may perhaps be usefully premised.

Jussieu, as remarked above (see *Ericaceæ),* in his original "Genera Plantarum," established his classes of Dicotyledonous plants, first, on the absence or presence of the corolla and its form, *mono-* or *poly*-petalous, and secondly, on its point of insertion with reference to the ovary and calyx; hence his divisions, *Hypogynous,* on the receptacle, and free from the calyx; *Perigynous,* on the lower part of the calyx, and *Epigynous,* on the throat of the calyx tube, or above the ovary, in those cases where the ovary was embraced by and united to the tube of the calyx. When the corolla is wanting the same series of terms is then applied to the insertion of the stamens. Four of his classes were appropriated to monopetalous plants, viz. Hypogynous, Perigynous, Epigynous, and Epigynous with united anthers. It is the orders appertaining to the first of these we are now about to examine.

De Candolle transposed this arrangement, giving a higher value to insertion than form, but still retaining the corolla, as an element in his arrangement, hence his *Thalamifloræ,* equivalent to Jussieu's Polypetalæ, hypogyna. 2d. *Calycifloræ,* including his Monopetalæ,

Polypetalæ, Perigynæ and Epigynæ; and Epigynæ antheris connatis. 3d. *Corolliflorœ*, equivalent to Monopetalæ hypogyna, and 4th. *Monochlamydeœ*, including all those orders in which the corolla is wanting. It is the third of these sub-classes we are now about to consider which includes, in his work, a continuous series of nearly 40 orders, without sub-division or grouping to assist us in referring any unknown plant to the order to which it belongs.

Endlicher and Meisner both follow Jussieu in assigning a high value to the corolla, their leading divisions in the distribution of their groups being, Apetalous, Monopetalous, and Polypetalous.

Lindley, on the other hand, in his last work, "The Vegetable Kingdom," altogether rejects the form of the corolla as an element in his general arrangement, adopting insertion alone as his basis, three of his four sub-classes of Exogens being respectively designated Hypogynous Perigynous and Epigynous Exogens, the superstructure of which is composed of "Alliances" not unfrequently made up of a group of orders in which apetalous, monopetalous and polypetalous families combine to form his circle, if the term be allowable.

How far science is to be benefited by this change remains to be ascertained. As it now stands, the advantage derived from it does not strike me as being by any means obvious, since the basis is nearly, if not to the full, as artificial as that of the old arrangement, and liable to nearly as great variations, even in the same orders, while many of the alliances include orders greatly at variance with their essential characters. See, for example, *Oleaceœ* in *Solanales.* But still, as such defects seem unavoidable, in the present state of our knowledge, I do not attach much importance to them and view his arrangement, as a whole, as a great step in the right direction, and have no doubt it will ere long prove a sure guide to a more perfect distribution, by leading to the discovery of a broad and natural basis on which to construct our natural system, and supersede the narrow and artificial one on which the noble edifice now stands.

Hitherto I have followed De Candolle's arrangement as my guide and, for obvious reasons, wish and intend to do so still. As, however, he has not thought fit to lighten the labour of investigating the orders of this extensive sub-class by distributing them into minor groups, either artificial or natural, I propose, by way of introduction to its study, to submit outlines of two schemes proposed for this purpose, each of which furnishes a conspectus of the orders, but constructed on somewhat different principles and occasionally leading to different results. The first was prepared by Dr. Arnott, Professor of Botany in Glasgow, the other by myself.

They are both, to a greater or less extent, artificial, but being different, may probably mutually assist each other in enabling the young Botanist to determine the order to which any unknown plant under examination may belong, and they both possess the charm of novelty, if that is any advantage, as neither has yet been published. In regard to Dr. Arnott's arrangement, it is necessary to guard against compromising him by allowing the reader to suppose for a moment that the accomplished Author considers it a perfect or final one. He thus writes, "The order I at present adopt in my syllabus for my class, is to divide *Corolliflorœ* into groups, perhaps too artificial, but of great use to students [the thing wanted here]. Perhaps I shall have to alter much of it when I have more time to study. I drew up the short characters to chalk on the board last summer when much hurried."

In regard to my own, it was prepared solely for this work, I fear also rather hurriedly, but it may still be found useful as an aid to the other, as being constructed on a different basis and associating different orders in the groups. Mine only includes the Indian orders.

A glance at our respective schemes will show that, notwithstanding the alleged badness of characters taken from the corolla, we coincide in viewing the sub-class, Corollifloræ, as a large and, upon the whole, natural assemblage of orders which it is necessary to divide and classify into minor groups, to facilitate their investigation and discrimination. For this purpose, apparently, as furnishing more obvious characters, Dr. Arnott

usually assigns the first place to the flower and its parts and has recourse to the ovary, fruit, and vegetation for secondary ones. I, on the other hand, on the supposition that the ovary and fruit furnish more constant and, in the main, more valuable ones, though less easily investigated, give them the first place in my classification.

The labour of investigation is the same, as it is equally indispensable, in both, that the structure of the ovary, seed-vessel, and seed should be known before determinate results can be arrived at, but the result is different. I do not venture to decide whose groups are the most natural, in the cases where they materially differ.

DR. ARNOTT'S SYLLABUS.

Group I. Ovary compound, of 4 or more carpels, 1- or several-celled (rarely inferior). Petals sometimes distinct from each other (or none). Stamens opposite the petals (alternate with the sepals), and of the same number, with or without the alternate sterile ones.

PRIMULACEÆ. Placenta large, central, free. Herbs.

MYRSINIACEÆ. Placenta central, free. Woody plants with linear transparent dots in the leaves.

SAPOTACEÆ. Ovary several-celled. Woody plants.

Group II. Flowers regular. Stamens more than two, alternate with the segments of the corolla and isometrical or more numerous. Ovary superior, cells isometrical with the sepals. Ovules solitary, in each cell, or in pairs, pendulous. Woody plants.

ILICINEÆ. Stamens as many as the petals. Stigma nearly sessile.

EBENACÆ. Stamens two or more times as numerous as the sepals. Style conspicuous.

Group III. Flowers regular. Ovary usually inferior of several cells. Stamens numerous, inserted on the corolla.

STYRACACEÆ. (This being the only order of the series with inferior fruit, no ordinal character is required.)

Group IV. Flowers regular, stamens 2 [or 4, usually] fewer than the segments of the corolla. Ovary superior or nearly so, 2-celled, petals sometimes wanting, ovules solitary or in pairs. Leaves opposite. [I have introduced the words within the brackets for the purpose of making room for *Azimaceæ*, which clearly belongs to this group, in every thing except the number of stamens; but for them and its very distinct habit, it might be admitted into the tribe *Chionantheæ* of *Oleaceæ.*]

JASAMINEÆ. Ovules erect or ascending, seed with little or no albumen, corolla decidedly gamopetalous.

OLEACEÆ. Ovules pendulous. Seeds with copious albumen. Corolla (sometimes wanting) sub-4-petalous.

AZIMACEÆ. Ovules erect. Flowers sub-4-petalous. Stamens isometrical.

Group V. Flowers regular or nearly so. Stamens isometrical with the lobes and alternating with them (if in-isometrical the leaves are stipuled). Carpels 2, more or less combined. Stigma short. Leaves opposite.

ASCLEPIADEÆ. Ovaries distinct. Stigma 1, dilated (with 5 corpusculiferous angles), pollen cohering in masses. Stipules none.

APOCYNEÆ. Ovaries distinct or united. Stigma 1, contracted in the middle. Pollen pulverulent. Æstivation twisted.

Loganiaceæ. Ovaries united, placentas axile. Stigma simple.

α. Spigelieæ. Æstivation of corolla valvate. Embryo *minute.* Flowers isometrical.
β. Strychneæ. Æstivation of corolla valvate. Embryo *large.* Flowers isometrical.
γ. Loganieæ. Æstivation of corolla convolute or imbricated. Flowers isometrical.
δ. Potalieæ. Æstivation contorted or imbricated. Flowers *not* isometrical.

Gentianeæ. Ovary 1-celled with parietal placentæ or half 2-celled, the placentæ attached to the introflexed margins of the valves. Stigma simple or bifid, or two. Flowers isometrical. Stipules none.

Group VI. Flowers almost always irregular. Fertile stamens 2 or 4 on the tube or base of the corolla. Ovary 1-celled with parietal placentas, or a central one, or 2-celled. Fruit not separating into nuts. Albumen none or present in those with a partly inferior ovary. Leaves almost always opposite or radical.

* Placentæ parietal.

Pedaliaceæ (and Sesameæ). Fruit bony or capsular. Embryo amygdaloid. Radicle short.

Gesneriaceæ. Fruit capsular or baccate. Embryo with minute cotyledons, radicle long.

Crescentiaceæ. Fruit succulent, hard shelled. Embryo amygdaloid, radicle short.

** Placentæ axile.

Bignoniaceæ. Seeds winged, sessile. Cotyledons leafy.

Acanthaceæ. Seeds wingless, attached to hard processes of the placentæ.

*** Placenta central, free.

Lentibularieæ.

The remaining groups are more briefly traced. I shall however introduce them to complete the enumeration of the series of orders, leaving, until I come to them, the essential characters of the orders composing them.

Group VII. contains—

* Stamens usually regular.

Polemoniaceæ. Diapensiaceæ. Convolvulaceæ. Cuscuteæ. Hydroleaceæ. Hydrophyllaceæ. Solanaceæ.

** Stamens usually irregular.

Scrofulariaceæ. Orobanchaceæ.

Group VIII. has—

* Flowers regular and symmetrical.

Nolanaceæ. Cordiaceæ. Ehretiaceæ. Borragineæ.

** Flowers irregular and unsymmetrical.

Labiatæ. Verbenaceæ. Myoporaceæ. Selagineæ.

Group IX. contains

Globularineæ and Plumbagineæ.

Group X. Plantagineæ.

He adds, in regard to that most anomalous order, Lentibularieæ, "I could easily have put it into a separate section or group, but I thought it unnecessary. It differs from the Primulaceous and Myrsineous groups in wanting albumen. Were it not for that character, I would have brought it near to Scrofulariaceæ. I prefer placing it as above to either my old place, or to De Candolle's. It is in no way connected with any other order, and it comes within my artificial character."

In the following Conspectus the orders referable to the Indian Flora are alone included.

CONSPECTUS OF NATURAL ORDERS OF THE CLASS COROLLIFLORÆ.

Group I. Ovary of several carpels. Placenta central, free. Fruit capsular or baccate, rarely 2-celled. Seed several or solitary by abortion, albuminous or exalbuminous.

A. Flowers regular. Stamens opposite the lobes of the corolla.

Fruit capsular, many-seeded. Seed peltate, albuminous. Herbaceous plants.	Primulaceæ.
Fruit drupaceous or baccate, usually 1-seeded by abortion, rarely inferior, several-seeded. Seed albuminous. Shrubby or arboreous.	Myrsineaceæ.
Fruit follicular, 1-seeded. Seed exalbuminous. Shrubs or trees growing in salt marshes, seed germinating on the tree.	Ægiceraceæ.
Ovary 1-seeded. Fruit capsular with a single seed pendulous from the apex of an erect podosperm. Seed sparingly mealy albuminous. Herbs or under-shrubs.	Plumbaginaceæ.

B. Flowers regular. Stamens alternate with the lobes of the corolla.

Fruit baccate, seed solitary, erect, exalbuminous. Shrubs or trees.	Salvadoraceæ.
Fruit capsular, 1- or spuriously 2–4-celled, seed few or several, albuminous. Embryo transverse.	Plantaginaceæ.

Group II. Ovary free or rarely adherent, 3 or more celled, with one or two pendulous ovules in each. Fruit baccate, several or often by abortion, one-seeded. Seed albuminous.

Ovary free, 4 or more celled, ovules solitary, pendulous. Fruit baccate, several or, by abortion, 1-seeded. Corolla few or many cleft. Stamens twice the number of the lobes, those alternate with the lobes usually sterile.	Sapotaceæ.
Ovary superior, 4–6-celled, with a pendulous ovule in each. Stigma sessile. Flowers regular; corolla 4–6-lobed, with 4–6 alternate stamens. Ovules often suspended from a fleshy caruncul us.	Ilicineæ.
Ovary superior, 3–4–8 or more celled, or as many cells as there are lobes to the corolla, with a solitary pendulous ovule in each. Flowers often dioicous: male, with the stamens two or more times as numerous as the lobes of the corolla; female with the style conspicuous, seed compressed, albuminous.	Ebinaceæ.
Ovary inferior, usually 3-celled, rarely 2- or 5-celled, ovules 2 or more in each, pendulous. Fruit baccate, several or, by abortion, 1-seeded. Seed albuminous. Flowers regular, stamens numerous, inserted on the base of the corolla. —Arboreous.	Styraceæ.

Group III. Ovary 2-celled with 1 or 2 ovules in each. Carpels right and left of the axis. Ovules erect, horizontal or pendulous. Fruit baccate or drupaceous.

Flowers unsymmetrical, tubular, 4-cleft or deeply 4-parted. Stamens 2. Ovary 2-celled, with 1 pendulous rarely ascending ovule in each. Fruit drupaceous. Seed albuminous or rarely exalbuminous.	Oliaceæ.
Flowers symmetrical, dioicous. Corolla deeply 4-parted or 4-petaled. Ovary 2-celled, ovules solitary, erect. Fruit baccate, seed compressed, exalbuminous.	Azimaceæ.
Flowers unsymmetrical. Corolla regular, tubular. Æstivation twisted, limb 5–8-cleft. Stamens 2. Ovary 2-celled, with 1 or 2 ovules in each. Fruit baccate, double or single by abortion. Seed exalbuminous or sub-albuminous.	Jasminaceæ.

Group IV. Ovary 2-celled, simple or double (i. e. not cohering in the axis). Fruit, when double, follicular, with numerous, usually imbricating, seed; when single, capsular or baccate,

and then usually few-seeded. Seed albuminous or sub-albuminous, carpels anterior and posterior (always?).

Ovaries double. Fruit follicular. Seed comose, albumen sparing. Stigma dilated, 5-angled, angles furnished with corpuscules to which the pollen becomes attached. Pollen solid, waxy or granular. Æstivation of corolla usually valvate.	Asclepiadeæ.
Ovaries either simple or double, 2- or rarely 1-celled. Fruit, when simple, baccate or capsular, when double, follicular. Seed sub-albuminous. Anthers 2-celled, often produced at the apex into a long appendage and spurred or sagittate at the base. Pollen pulverulent. Æstivation of corolla convolute.	Apocynaceæ.
Ovaries simple, 2-celled, placentæ axile. Stigma simple or slightly 2-lobed. Anthers free, pollen pulverulent. Fruit capsular or baccate. Seed albuminous. Æstivation of corolla usually valvate, sometimes convolute.	Loganiaceæ.
Flowers regular, corolla 4–5-lobed. Æstivation twisted. Stamens as many as the lobes. Carpels 2, anterior and posterior; placentiferous margins more or less introflexed. Stigma bifid or two. Fruit capsular, septicidal, seed numerous, albuminous. Herbs, rarely shrubs.	Gentianaceæ.

Group V. Ovary of 2 or more carpels, 1- or 2-celled or spuriously 2 or more celled from the introflexed carpillary margins imperfectly meeting in the axis. Placentæ either strictly parietal, or borne on the dilated loosely introflexed margins of the carpels. Fruit capsular, many, or rarely few-seeded, dehiscing loculicidally or rarely septicidally. Seed exalbuminous.

Flowers irregular. Carpels 2 or more? when more than two placentæ strictly parietal; when two, the margins usually introflexed dilated and revolute, bearing the placentæ on their loose margins, occasionally partially meeting in the axis, forming a spuriously 2-celled ovary. Fruit capsular, loculicidal. Seed albuminous; testa scrobiculate. Parasitic, herbaceous plants, with scales in place of leaves.	Orobanchaceæ.
Flowers irregular. Stamens 2. Fruit capsular, of 2 carpels dehiscing laterally, many-seeded, seed exalbuminous sometimes peltate, testa rugous. Herbaceous, sub-aquatic plants.	Lentibularieæ.
Flowers irregular, ovary 1-celled. Carpels 2, anterior and posterior, placentiferous margins dilated, loosely introflexed, revolute. Fruit capsular, loculicidal, or baccate. Seed exalbuminous often borne on a long slender podosperm.	Gesneraceæ, *sub-order* Cyrtandraceæ.
Flowers irregular. Placentæ axile. Capsule compressed, dehiscence marginal loculicidal? Seed winged, exalbuminous. Shrubby or arboreous.	Bignoniaceæ.
Flowers irregular, carpels 2, right and left of the axis; margins introflexed, meeting in the axis and forming (in Sesamum) a 4-angled central placenta; and spuriously 4-celled ovary, or introflexed and revolute, forming, in Pedalium, an imperfectly 2–4-celled ovary. Fruit capsular, septicidal or bony. Seed exalbuminous. Herbs.	Pedaliaceæ.
Flowers irregular. Stamens 2–4, didynamous. Carpels 2, inflexed, often not meeting in the axis. Ovary 1- or 2-celled through the intervension of a membrane uniting the margins of the carpels. Placenta parietal. Fruit capsular, loculicidal dehiscing elastically. Seed exalbuminous, usually attached to hard processes. Herbs or shrubs, or rarely sub-arboreous.	Acanthaceæ.

Group VI. Ovary 1–2–4-celled; cells with 1–2 or few ovules in each. Fruit baccate, capsular or drupaceous, albumen generally sparing in quantity.

Flowers more or less irregular. Stamens 2 or 4, rarely 5 or more. Ovary 2–4-celled, ovules 1 or 2 in each, ascending or pendulous. Fruit drupaceous or baccate, 1-seeded or composed of 2 or 4 adherent nuts. Seed erect or ascending. Radicle inferior.	Verbenaceæ.
Flowers irregular, 2-lipped, 5-lobed. Style 1, simple; stigma 2-cleft; ovary deeply 4-lobed, 4-celled with a single ovule in each. Fruit 4 (rarely 1) small nuts. Seed exalbuminous.	Labiatæ.

Flowers regular. Stamens equalling the lobes of the corolla. Ovary composed of 2 carpels anterior and posterior, 2- or spuriously 4-celled. Cells 2- or 1-seeded. Fruit drupaceous or composed of 4 achænia. Seed exalbuminous.	Borragineæ.
Flowers unsymmetrical. Stamens 5. Stigmas 5. Corolla 10-lobed. Ovary 1-celled with 4 erect basal ovules. Fruit baccate. Seed solitary, cotyledons plicate in mucilaginous albumen.	Erycibeæ.
Flowers regular, infundibuliform, plicato-convolute in æstivation. Ovary 1–2–4-celled, cells with 1–2 or rarely 4 ovules; placentæ basalar. Fruit capsular or baccate. Cotyledons conduplicately corrugated, albumen mucilaginous. Twining herbs or shrubs.	Convolvulaceæ.

Group VII. Ovary 2-celled, placentæ axile, carpels anterior and posterior, fruit baccate or capsular. Seed albuminous. Herbs, shrubs or trees.

Flowers regular. Styles two. Fruit capsular, dehiscence loculicidal. Seed albuminous.	Hydroleaceæ.
Flowers regular. Stamens generally isometrical with the lobes of the corolla. Æstivation often plicato-convolute. Fruit baccate, seed albuminous, often compressed, lenticular.	Solanaceæ.
Flowers irregular. Stamens 2 or 4 didynamous. Fruit usually capsular. Seed albuminous.	Scrofulariaceæ.

A cursory review of these groups will show that although artificial in their mode of construction, they yet bring together some very natural assemblages of orders.

As regards the first, I almost doubt whether the orders composing it can be more naturally placed, at least in the present state of the science. *Salvadoraceæ* is, perhaps, an exception, its affinities are still very obscure and do not appear to lie here, its present location, therefore, is purely on account of its solitary, basalar ovule in which it coincides with *Plumbagineæ*. *Plantagineæ* is another difficult order to place, but all Botanists agree in keeping it near *Plumbagineæ*.

The second group, though in many respects unlike the first, agrees in having several, indefinite, (not 2 or 4) carpelled ovaries. The orders composing it are associated by nearly all Botanists. It is true Dr. Arnott, in his temporary arrangement, has placed *Sapotaceæ* in his Myrsineous group, and Dr. Lindley has divided them; but by stationing *Sapotaceæ* and *Styraceæ* at the end of one alliance, and *Ebenaceæ* and *Ilicineæ* at the head of the next, they stand in his linear series, nearly as I have placed them. The connexion between them and the associated orders of both Alliances I am unable to trace. With the exception of *Ilicineæ* my series corresponds with De Candolle's.

The third, group though small, does not seem so natural. *Oleaceæ* and *Azimaceæ* are certainly near relations, not so *Jasmineæ*. Its true affinities must, I apprehend, be looked for in the next, as suggested by Lindley, who places it in his Echial alliance among the orders forming my 4th group. Its right and left carpels, added to its peculiar placentation, and mode of development of the ovules, indicate a relationship to *Verbenaceæ*.

The fourth group conveniently keeps together the 4 orders of which it consists. Though all complex in their composition, they are so nearly allied and so interblended with each other that nearly all Botanists seem to think it next to impossible to separate them without doing violence to nature. Dr. Lindley, however, has seen reason to divide them, placing *Gentianeæ*, *Loganiaceæ* and *Apocynaceæ* in his Gentianal Alliance and *Asclepiadeæ* in his Solonal. I do not myself see the principles on which the separation is made, neither can I trace the relationship between *Asclepiadeæ* and *Solanaceæ*. *Gentianeæ* clearly belongs to this group, but to some extent possesses the ovarial character of the next, it therefore forms a suitable transition.

The fifth group is, with two exceptions, *Lentibularieæ* and *Orobanchaceæ*, made up of a series of orders which have always been recognized as closely allied. *Lentibularieæ* which I bring here, principally, on account of its dicarpillary ovary and irregular flowers, exal-

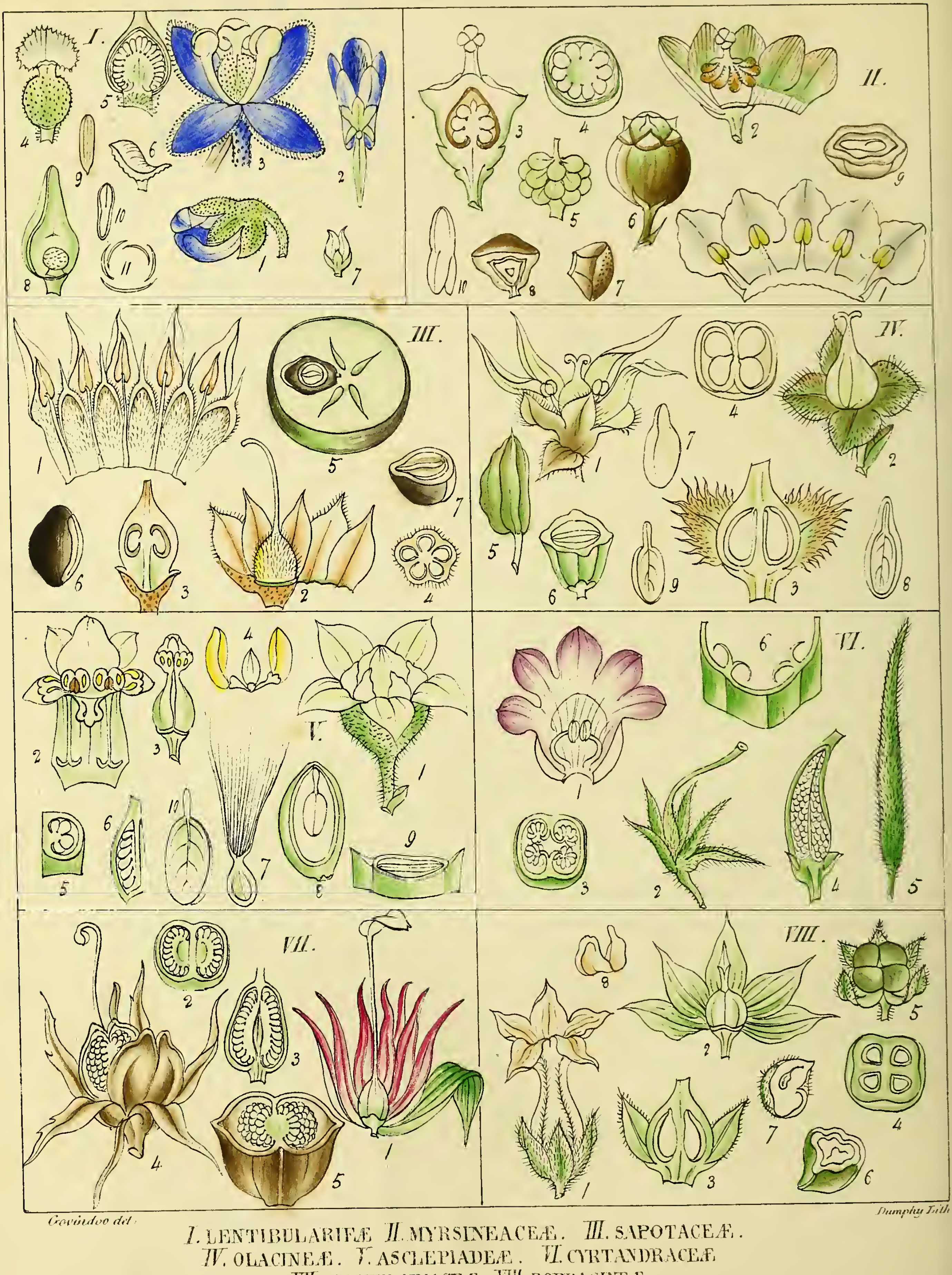
buminous seed and capsule dehiscing laterally, not vertically, is a very anomalous order, having, apparently, no really near relations. As regards placentation it undoubtedly associates with, and was at first referred to, my first group (where it is placed in plate 142), but the ovary has only two carpels and the flowers are irregular. Owing to its "having the same calyx, corolla, stamens and bivalve capsules," as Scrofulariaceæ, many eminent Botanists esteem it more nearly allied to that order than to any other, and, in defference to their judgment, I was at first disposed to place it in my last group, though I thought the relationship remote. I now prefer placing it here because I feel disposed to view it as much more nearly related to *Cyrtandraceæ* than to *Scrofulariaceæ*, and consider that this is its proper location in the Vegetable system. The habit, the lateral not vertical dehiscence of the capsule, and the exalbuminous seed, all combining to confirm this view and show that its affinities appertain much more to *Cyrtandraceæ* than *Scrofulariaceæ*. *Orobanchaceæ*, which I have brought here on account of the ovarial structure, is one of those complex families which claim relationship with several others, but is, I believe, notwithstanding its albuminous seed to the full as naturally stationed here as in either the Gentianal Alliance, where Lindley places it, or in the Solanal to which it is usually referred. It seems in fact to form the connecting link between the Bignonal and Solanal groups, fluctuating between *Cyrtandraceæ* and *Scrofulariaceæ*, having the ovarial structure of the former, the albuminous seed of the latter, and the flowers of both. Acanthaceæ certainly belongs to this group.

The sixth group forms a very natural assemblage, *Erycibeæ*, perhaps, excepted, the true affinities of which are still undetermined. Lindley refers the genus *Erycibe* to Ebenaceæ, but I think erroneously. I have brought it here on account of its basal placentation, besides which it has at different times been referred to both *Convolvulaceæ* and *Borragineæ* and is finally raised to the rank of an order by De Candolle and placed between them.

The orders of the seventh group seem all nearly related. *Hydroleaceæ* forms the connecting link between them, having the flowers of *Convolvulaceæ* and the ovary of *Solanaceæ*. Lindley, however, refers it to his Cortusal Alliance, which is nearly identical with my first group, but evidently under the erroneous impression that *Hydrophyllaceæ* and *Hydroleaceæ* form parts of one order which they do not. Choisy, with, I think, more justice, indicates the vicinity of *Solanaceæ* as its probable station in the Vegetable system. Between *Solanaceæ* and *Scrofulariaceæ* it is exceedingly difficult to find distinguishing marks; Lindley however places them in different Alliances, viewing the first as the typical order of his Solanales, and placing the second among his Bignoniales, principally, I believe, on account of the symmetrical flowers of the one and the unsymmetrical ones of the other.

Botanists justly lay much stress on characters taken from the albumen, especially when very copious, as being physiological and therefore, more constant and valuable, than structural ones, which are liable to alter under the influence of variations in the external circumstances under which they are produced. But this is liable to exceptions, especially in acquatic and marshy plants. It is wanting, for example, in *Ægiceraceæ* and *Lentibularieæ*, both of which, by ovarial structure, associate with *Primulaceæ* and *Myrsineaceæ*, albuminous orders. In such a case whether is the physiological or structural character to have the preference? Lindley, in constructing the diagnostic characters of his alliances, always assigns to albumen a high value, but is not rigid in the application of his own rules in practice, by excluding orders greatly at variance, in that respect, with the character of the alliance. As a generic or ordinal character, the presence of a notable quantity of albumen furnishes a character of the greatest value, but assuming Lindley's alliances to be near approximations to natural groups, and bearing in mind the often wide discrepancies in regard to its quantity, presented by different orders entering into their composition, I feel disposed to look upon it as a difficult subject to deal with in associations higher than orders. And even in the case of orders it requires to be used with care, as far as possible in such a manner as to avoid superseding those taken from external structure, unless, by the way, it is our wish to render them altogether subordinate, as for example in the construction of classes or groups dependent on the presence or absence of that organization, when, if rigidly adhered to, all others must of course give way to them.

But to an albuminous class, it may and will be objected, that it can only be completed



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I. LENTIBULARIFÆ II. MYRSINEACEÆ. III. SAPOTACEÆ.
IV. OLACINEÆ. V. ASCLEPIADEÆ. VI. CYRTANDRACEÆ
VII. SCROFULARIACEÆ. VIII. BORRAGINEÆ.

by assigning too high a value to this important physiological character and rendering it most artificial in practice. Numerous genera and even whole sections, of what are now considered very natural families, are deficient in albumen, while in the remainder it is copious. *Oleaceæ* furnishes an example in point. In the section *Oleineæ* albumen abounds, but is wanting in *Chionantheæ;* these two nearly allied sections, as regards external structure, of this natural order would therefore be widely separated in a capological system, while the others, less closely allied by external characters, would be kept together. This example shows both the difficulty and importance of assigning a just value to characters, whether physiological or structural, and that overvaluing either inevitably leads to disruption of affinities.

The position of the carpels, in dicarpillary ovaries, in relation to the axis, is another character the true value of which has yet to be ascertained. I have occasionally used it in the above synopsis, but always with hesitation, from finding it vary in different genera referable to the same order, and from often finding it a difficult character to make out, and therefore one requiring to be used with much caution.

In the following plate, No. 142, I have given figures explanatory of the characters of my seven groups of Corollifloræ. The drawings being taken from plants not intended for representation in the subsequent portions of the work, I am thus enabled to introduce a greater number of subjects in illustration of this division than I should otherwise have been able to do.

EXPLANATION OF PLATE 142.

I. Lentibularieæ.

(Pinguicula Vulgaris.)

1. Flower-bud magnified.
2. Flower and spur seen from behind.
3. Expanded flower showing the stamens and pistil.
4. Pistil detached.
5. Ovary cut vertically.
6. Stigma, side view.
7. Mature capsule, natural size.
8. Same, anterior valve magnified.
9. Seed magnified.
10. Same cut longitudinally.
11. Diagram (from Nees' gen. plant.)

II. Myrsineaceæ.

(Mæsa indica.)

1. Detached corolla split open, stamens opposite the lobes.
2. Ovary and calyx, the calyx split open and forcibly separated from the base of the ovary.
3. Ovary cut vertically.
4. —— transversely.
5. Placenta and ovules detached.
6. Full-grown fruit.
7. A mature seed.
8. The same cut from above, showing the transverse embryo.
9. Cut across, embryo in situ.
10. Embryo detached.

III. Sapotaceæ.

(Sapota Elingoides.)

1. Corolla split open, showing the alternate fertile and sterile stamens.
2. Calyx and ovary.
3. Ovary cut vertically.
4. —— cut transversely.
5. Mature fruit cut transversely, all the ovules but one aborted.
6. Mature seed.
7. —— cut transversely, albuminous.

IV. Oleaceæ.

(Olea linocieroides.)

1. Expanded flower.
2. Calyx and ovary.
3. Ovary cut vertically, ovules pendulous from the apex.
4. —— cut transversely.
5. Full-grown fruit.
6. —— cut transversely.
7. Detached seed.
8. —— cut longitudinally, albuminous.
9. Embryo detached.

V. Asclepiadeæ.

(Gymnema Decaisneanum.)

1. Detached flower.
2. Gynostigium removed from the flower.
3. Ovary and stigma with the pollen masses attached.
4. Detached pollen.
5. One limb of the ovary cut transversely.
6. Cut longitudinally.
7. A seed and coma.
8. Cut longitudinally, showing embryo in situ.
9. Cut transversely.
10. Detached embryo.

VI. Cyrtandraceæ.

(Didymocarpus ovalifolia.)

1. Corolla laid open to show the insertions of the stamens.
2. Calyx and ovary.
3. Ovary cut transversely, showing the free revolute placentiferous margins.
4. Cut longitudinally.

VII. Scrofulariaceæ.

(Limnophila hypericifolia.)

1. Calyx, ovary, and bract.
2. Ovary cut transversely, placentæ axile.
3. Ovary cut vertically.

4. Capsule in the state of dehiscence.
5. Capsule cut transversely.

VIII. Borragineæ.

(Heliotropium linifolium.)

1. A flower full blown.
2. Calyx and ovary.
3. Ovary cut vertically.
4. —— transversely.
5. Mature fruit.
6. Nut cut transversely.
7. —— vertically.
8. Embryo detached.

XCIV.—LENTIBULARIEÆ.

The two genera, of which this order was originally composed, were placed, by Jussieu, among a number of others as allied to his order *Lysimacheæ*, the present *Primulaceæ.* In 1806, Hoffmansegg and Link separated them to form the type of the present order, under the name of Utricularinæ. In 1808, Richard, probably without being aware that he was anticipated, adopted a similar view of their affinities, and published them as a new order, under the name of *Lentibulariæ.* His less appropriate name was adopted by Brown in 1810, though aware of the existence of the other and older one, which he quotes. Since that time the older name has been generally set aside until recently revived by Endlicher and Miesner who in this instance stand nearly alone in respecting the rights of priority,* which seems the more remarkable as the genus *Lentibularia* has been long since reduced to a synonym of *Utricularia.*

The family consists of numerous small species of aquatic and marshy herbaceous plants: the former float on the surface by means of numerous small bladders attached to their leaves. As regards the distinction of species this is a very difficult order, especially the genus *Utricularia*, the only one found in Southern India, the species of which are numerous, and afford few marks of distinction even in the recent state, and when dried some of the best, those derived from the flower, are often either lost or so much impaired by the process as to become of little value. The flowers are usually small, those of *U. reticulata* being among the largest of the Indian ones. In colour they vary, yellow and various shades of blue predominating, but red and white are also occasionally met with. The seed are very minute, but considerably diversified as regards form and surface, and promise, when more attention has been given to them, to furnish useful specific characters. In some they are lenticular reticulate on the surface, in others lenticular smooth, and bound all round with a membranous wing; in others ovoid, scrobiculate, foveolate, glochidiate, &c. Hitherto they have not been interrogated for specific characters, but promise in the herbarium to furnish the best and most easily accessible ones. Those taken from the scales and relative sizes of parts seem liable to variation and cannot always be depended upon, where dried specimens are under examination.

Character of the Order. Calyx 2-parted or more or less bilabiate, the inferior one often larger, in *Utricularia*, often emarginate or bidentate. Corolla personate or bilabiate, rarely regular; the upper lip 2-lobed or entire, the under larger, spurred at the base, 3-lobed or entire. Stamens two, inserted on the base of the corolla, between the spur and ovary: filaments somewhat flattened, often bent, approximated at the base and apex: anthers terminal, ellipsoid, one-celled, often contracted in the middle, as if 2-celled, dehiscing above. Pollen (dry) broadly elliptical. Ovary free, ovoid, 1-celled: placenta central, free, ovoid or globose, shortly stipitate at the base. Ovules numerous, anatropous or peltate. Stigma 2- or 1-lipped (the upper one being obsolete) the lower one larger, often dilated and revolute over the anthers. Capsule globose or ovoid, bursting laterally or irregularly. Seed numerous, minute, testa often rugous, albumen wanting. Embryo orthotropous, sub-cylindrical, sometimes undivided, sometimes with two short cotyledons. Herbaceous aquatic or marshy plants, with entire or compound radical leaves; in the latter case usually floating, the leaves resembling roots and bearing numerous small bladders, scapes slender, erect or twining, naked or furnished with scales; flowers either solitary or several, forming a raceme towards the apex.

* I was not aware of this fact when sending the accompanying plate to the Lithographer, otherwise I should have adopted the older name.

Affinities. These seem to be obscure, but according to the general sense of Botanists of the present day, the order is badly placed here, nearly all recent writers coinciding in viewing it as more correctly referable to the Scrofularinous or irregular flowered group of orders, than to the Primulaceous, with which its principal point of association is the one-celled ovary and central placenta. As regards the flower, it is certainly personate; but as regards the ovary, primulaceous, the anatropal position of the ovules on the placenta also accords better with the latter than the former. Brown, in his Prodromus, places it between the two, which seems to be its proper place, as partly agreeing with both in its structural peculiarities while it differs from both in its exalbuminous seed. But the value of this last character seems still undetermined, much more importance being assigned in some cases than in others, owing apparently to its use in the vegetable economy, not being as yet correctly understood. Lindley, for example, remarks under *Ægicereaceæ*, "It does not, however, appear to me advisable to distinguish the genus from Ardisiods, for it may be conjectured that the absence of albumen, which is one of the most important marks of distinction, is owing to the peculiar circumstances under which Ægiceras germinates; its embryo is always devolved in an atmosphere charged with moisture, and hardly requires that any special preparation should be made for sustaining it in its infant state." If this conjecture is correct the same reasoning is, I presume, applicable to seed germinating in water, and thence, as a consequence, that the seed of aquatics and marsh plants should not require albumen which, however, is not found to be the case. Its absence in this family and presence in *Scrofulariaceæ*, many of the species of which are marsh plants, may therefore be looked upon as of higher import than the preceding extracts would, *a priori*, lead us to suppose. Under this view of the case it seems, considering the high value justly assigned to physiological characters, that this order, which fluctuates between the two groups, is about equally remote from both as wanting their most important character, albumen, while it has the flowers of the one and the ovary and placenta of the other.

But may it not be more nearly related to an intermediate group than to either of these. In *Cyrtandraceæ* the flowers are irregular, the anthers are terminal and dehis above, the stigma is dilated and persistent, the capsule bursts laterally, not vertically through the stigma, the placenta in *Epithema* is basal, and lastly the seed are exalbuminous. In all of these respects there is much similarity between the two orders, enough I think to establish a much nearer relationship between them than between *Lentibularieæ* and *Scrofulariaceæ*, though still sufficiently remote. Upon the whole I am disposed to view this last as by far the closer of the two, the flowers being irregular and the seed exalbuminous in both and, in at least one instance, the placenta of *Cyrtandraceæ* is basal, not parietal, while in nearly all the ovary is one-celled.

Geographical Distribution. The species of this family are dispersed over the whole earth, but most abound in the tropical regions of the Old World and New Holland, inhabiting still or gently flowing waters and marshy grounds. The Pinguicolas are all natives of the Northern Temperate Zones, the Utricularias extend far into the Southern.

Properties and Uses. On this head nothing is known regarding those natives of India, and but little of any note of the others.

Remarks on Genera and Species. This order includes 4 genera and 175 published species, a large proportion of which are from South America. Of the above number 24 only, all species of *Utricularia*, belong to the Indian Flora, a number far short of what I feel certain will be found when their distinguishing characters are better known. Until recently the species of that genus have been most inadequately described, hence I find it most difficult to determine, among those in my collection, what are from those that are not named. This imperfection seems to have arisen not so much from any want of distinctive marks as from imperfect observation. The plants are, it must be admitted, most simple, and many so exceeding like each other that one is apt to associate several as a single

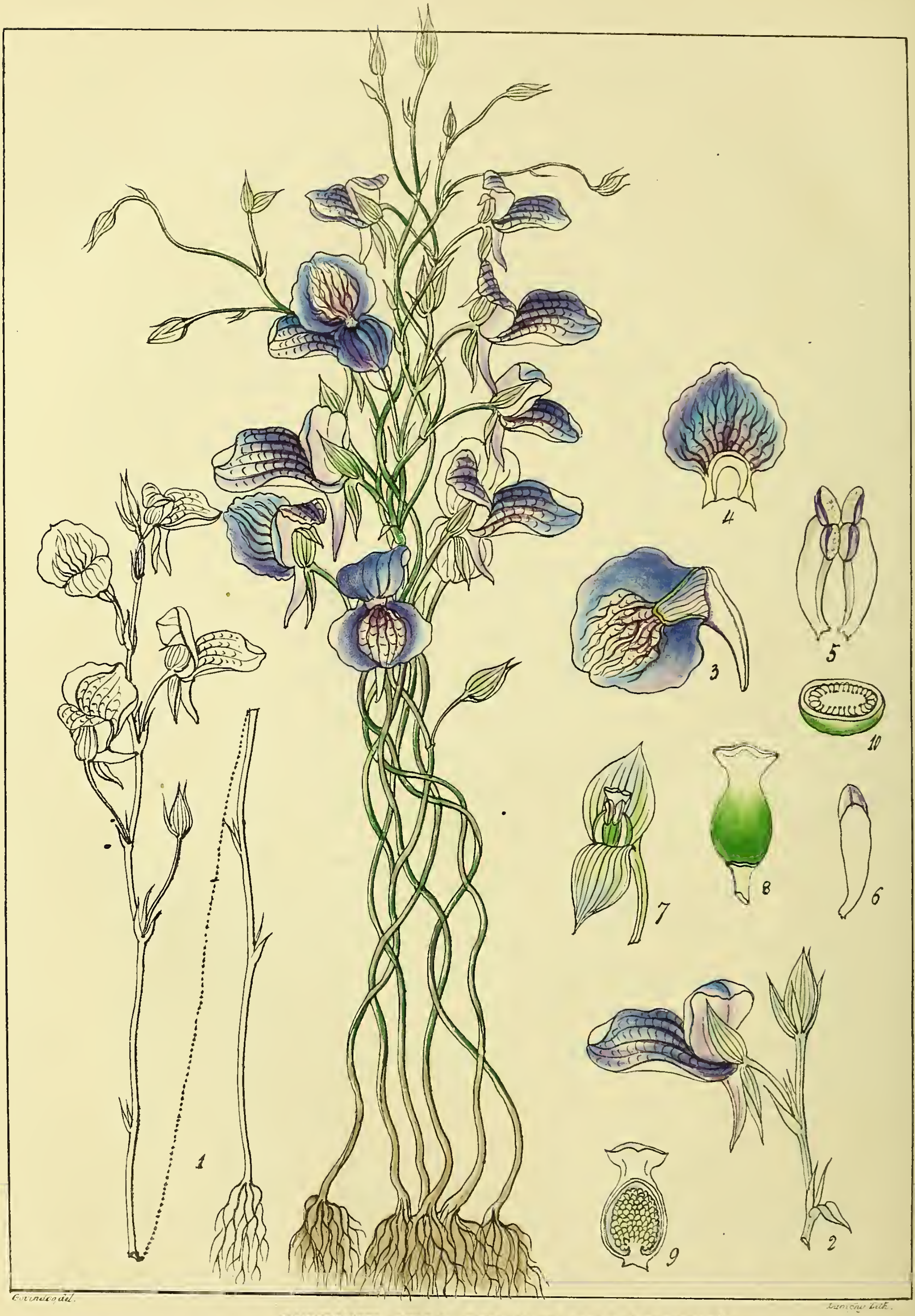
species, which more careful examination would readily show were quite distinct. The points from which characters are taken are the roots and leaves; form and mode of attachment, by the middle or base, of the scales on the scape and the bracts at the origin of the pedicels; the length of the pedicels in comparison with the bracts and flowers; the form and size of the calyx lobes, whether acute, blunt, or orbicular; the form and colour of the corolla, the relative size of the lips to each other and to the length of the spur; the spur, whether long or short, pointed or obtuse; the capsule, whether ascending or drooping, longer or shorter than the calyx, compressed or globose; and lastly the form of the seed, whether globose, oblong, or compressed, elliptical, or ovate and pointed at one end, smooth, or reticulated, spirally furrowed or glochidiate.

From this enumeration of the points whence distinctive characters may be drawn it is obvious they furnish an ample store to ensure their ready discrimination in all cases where carefully examined. And having subjected most of those in my collection to such an examination I find, though far from perfect, that it contains as many species as De Candolle enumerates for all India. I consider my collection imperfect, because I have only recently learned how to examine a *Utricularia*, and feel certain that I have passed unheeded many species on the supposition that I had already specimens in my Herbarium. In collecting specimens care ought to be bestowed on getting them as perfect as possible, especially as regards the flower and fruit. This last should never be neglected, as the seed, though minute, furnish, under the microscope, excellent specific characters, of which I shall supply several striking examples in an early part of my Icones, to which I feel constrained to refer, having already devoted so much space here to the consideration of this unassuming but certainly curious and ill-understood family. In the following Conspectus, I give synoptial characters of all the Indian species known to me.

CONSPECTUS OF INDIAN UTRICULARIÆ.

Floating. (Calyx, lobes herbaceous, not covering the capsule.)
- Calyx equalling the capsule, at length diverging. Seed peltate, wingless.
  - Scapes with a whorl of floats below the flower. - - - - - - - U. stellaris.
  - Scapes without floats. - - - - - - - - - - - U. fasciculata.
- Calyx shorter than the capsule appressed, seed flat, bound with a wing.
  - Scapes 3–5 or more flowered, seed-wing dentate. (The flowers of this species appear blue, all the others of this group have them yellow.) Mergui. - - - U. punctata.
  - Scapes two-flowered, seed-wing entire. - - - - - - U. diantha.

Terrestrial. (Calyx lobes enlarging becoming, in fruit, sub-scariose, converging and covering the capsule.)
- Calyx lobes ovate, sub-acute; scales and bracts attached by the base.
  - Seed finely reticulate, ovate, oblong.
    - Flowers some shade of blue (not yellow).
      - Calyx acute, seed elliptical, obtuse at both ends.
        - Spur shorter than the lower lip, descending. - - - - - U. reticulata.
        - Spur equalling or exceeding the lip, arcuate, horizontal. - - - U. arcuata.
      - Calyx blunt, sub-orbicular in fruit, seed ovate, pointed at one end. - - - U. humilis.
    - Flowers yellow (seed oblong, elliptical). - - - - - - U. Wallichii.
  - Seed finely reticulated, globose.
    - Spur as long or longer than the lower lip.
      - Cæspitose, leaves sub-spathulate, scapes lax. - - - - - U. conferta.
      - Distinct, sub-aphyllous, scape sub-voluble. - - - - - U. uliginoides.
    - Spur shorter than the lip, scape straight, erect. - - - - - - U. uliginosa.
  - Seed scrobiculate, flowers blue.
    - Scales on the scape few, appressed.
      - Pedicels longer than the flower.
        - Spur about the length of the lip.
          - Upper lip of the corolla sub-orbicular. Seed simply scrobiculate, (flowers as large and like those of *U. reticulata*). - - - - - U. Smithiana.
          - Upper lip linear, truncated, seed foveolate (flowers much smaller than those of the above plate: apparently aquatic, growing in shallow water). - - U. Griffithii.



UTRICULARIA RETICULATA (SMITH)

Spur much shorter than the lip, pedicels long. - - - - - - U. pedicellata.
Pedicels shorter than the flower.
Flowers subsessile or very short pedicelled; upper lip of the corolla emarginate. U. brachypoda.
Flower distinctly pedicelled, upper lip of the corolla entire. - - - - U. affinis.
Scales of the scape numerous, sub-cernuous (not appressed). - - - - U. squammosa.
Seed papillosely hispid, flowers yellow (scales on the scape sub-foliaceous). - - U. macrolepis.
Calyx lobes obovate or sub-orbicular, bracts and scales attached by the middle or above the base.
Seed glochidiate, scales attached a little below the middle, lower lobe obtuse: (seed ovate oblong, acute at one end: lobes of the calyx very unequal: spur conical: upper lip emarginate, under sub-orbicular, spreading, 5-toothed: leaves orbiculato-spathulate, scape flexuose). - - - - - - - U. glochidiata.
Seed reticulated not glochidiate, scales attached by the middle, acute at both ends.
Flowers sub-sessile.
Spur longer than the lower lip.
Flowers somewhat remote, sub-racemose. - - - - - - - U. nivea.
Flowers congested, spicate on the apex of the scape (the flowers of both these are nigrescent in drying, but do not appear to differ in colour, hence I suspect an error in the name *cærulea).* - - - - - - - U. cærulea.*
Spur shorter or about the length of the lip (lip large revolute on the margin, covering and nearly concealing the spur). - - - - - - - U. racemosa.
Flowers longish, pedicelled, seed scrobiculate. - - - - - - U. bifida.

* U. cærulea and filicaulis appear to be varieties only of the same species. The former young with the first flowers only open, the latter old with the short spike elongated into a fructiferous raceme. My specimens show, I think, the transition.

EXPLANATION OF PLATE 143.

Utricularia reticulata (Smith), nat. size.

1. A detached plant, natural size.
2. Portion of a raceme, natural size.
3. Lower lip of the corolla.
4. Upper lip.
5. Stamens, front view.
6. A detached stamen, back view.
7. Calyx and ovary with the stamens left to show the relative size of parts.
8. Ovary detached.
9, 10. Vertical and transverse sections of an immature fruit.

Through an unhappy oversight, a figure of the seed was omitted. They are nearly ovate, smooth, marked with slender, scarcely raised reticulations.

XCV.—PRIMULACEÆ.

This order was first published in 1789 under the name of *Lysimachiœ*, by Jussieu, again by Ventenant in 1799 under its present name, which Brown in 1810 adopted in preference to the older and, as it appears to me, equally correct name, and has been followed by all subsequent writers. In its habits it is very decidedly extratropical, hence is nearly unknown in the tropical parts of India, four species only being as yet known to me, appertaining to the continental flora, and one or two more from the mountains of Ceylon. To this family the Primrose, Oxslip. Cowslip, Lousestrife, and Pimpernel belong. The two last furnish Peninsular species, but on the Himalays several species, of *Primula* are found. In Europe the Primulas flower in early spring, or inhabit cold mountain tops and then flower in summer, while the Lysimachias and Anagalles, flower in summer or autumn. This difference in habit seems to account for, our finding the latter only within the tropis, while the spring ones, loving a colder climate, do not extend beyond the northern mountains.

Character of the Order. Calyx 5, seldom 4-cleft, inferior or half superior, regular, persistent. Corolla monopetalous, hypogynous, regular, the limb 5, seldom 4-cleft. Stamens inserted on the corolla, equal in number to its segments and opposite to them. Ovary 1-celled: style 1; stigma capitate; ovules usually amphitropal rarely anatropal. Capsule opening with valves; placenta central distinct. Seeds numerous peltate; embryo included within a fleshy albumen, the radical indeterminate or across the hilum.

Annual or perenneal herbaceous plants sometimes almost shrubby. Leaves usually radical,

when cauline whorled, opposite, or alternate. Stipules none. Flowers either on radical scapes umbelled, or variously arranged in the axils of the leaves, or forming terminal racemes or spikes.

Affinities. These are certainly with *Mysineaceæ*, in which the stamens, as here, are opposite the lobes of corolla, and the placenta free. Indeed so nearly are they related, that some eminent Botanists propose uniting them as parts of one order, distinguished rather by habit than characters, the one, *Primalaceæ*, being herbaceous while *Mysineaceæ* are shrubby and arboreous. Were habit to be altogether rejected as an element in the construction of orders, this would be right, but, following the present fashion in Botany, I am inclined, with Lindley, to view this as being as distinct an order as many now generally admitted without question. It is quite true that in other orders we find similar anomalies in respect to habit which are overlooked in them, but, as these are for the most part confined to single genera, they do not carry the same weight. Here we have two large groups of plants the one generally herbaceous and peculiarly extratropical in its habits, the other arboreous and woody and to an equal degree tropical in its. De Candolle mentions *Lentibularieæ*, as another nearly related order. If the views I have ventured to propose under that order, as to its affinities, be correct the relationship must be viewed as remote, and I believe it is remote, though it must be admitted they agree to a considerable extent in habit and, therefore, that *Gesneraceæ* may, like *Lentibularieæ*, be looked upon as an analagous, though hardly an allied order. Lindley adds "the collateral affinities are much more with *Solanaceæ*, and *Diapensieæ* to both of which they are similar in habit" than with *Portulaceæ*, as suggested by Duby. According to my views of natural affinities, which may however be very imperfect, I can see but little of even analogy between Primalaceæ and any of the three orders named.

Geographical Distribution. As remarked already this is a peculiarly extra-tropical order, so much so indeed, that some species of Primula exist almost on the limits of perpetual congelation, and all the family seek a low temperature. But while this is the case, we yet find that it exists in different degrees; one half of the family seeking lower thermometrical ranges than the other. The genera *Primula*, *Androsase*, and *Trientalis* are all early flowers in Europe. While *Lysimachia*, *Anagallis* and *Mycropyxis*, flower late in summer. The latter are found in the more temperate regions of the tropics, not the former. Of the whole order, about 215 species are named, two only are referred to our Peninsular flora, but two others are known to me, the one here figured and a species of *Micropyxis*. Europe and Northern Asia, are their principal centres, but Africa, America and New Holland, participate.

Properties and Uses. On this subject little seems known, or rather I should say they are nearly destitute of active properties.

As objects of ornamental culture, the Primulas can scarcely be excelled in their chaste, unassuming forms and colours, and being all early flowering plants, their beauties are enhanced by having at that season so few competitors, but they are ill adapted on that very account for culture, on even the highest and coldest peaks of our southern mountains, *Lysimachia Leschenaultii*, the *L. Clemensoneana* of Wall. List, a native of the Neilgherries and Pulney mountains, is however a rather handsome species, and being a free grower in the garden, though quite a marsh plant in its native localities, is extensively introduced into gardens on the Neilgherries. The one here represented has, as seen in its native pastures, but little beauty to recommend it, however well it may look on paper, still it seems probable, that if introduced into the parterre and well cultivated it might also become a favourite.

Remarks on Genera and Species. A flora possessing only three or four species furnishes little scope for reflection under this head. M. Duby, in De Candolle's Prodromus, names 8 Indian species of *Lysimachia*, only one of which appertains to the Peninsula, the one here figured is a second; the others are all from the Northern provinces. Ceylon has one or two distinct from the Peninsular species, apparently unknown to Duby, as I do not find he refers to them. The other genera found so far south are *Anagallis* and *Mycropyxis*, of the former there is one found

Gorndoo, del. Dunphy, Lith.

LYSIMACHIA DELTOIDEA (R.W.)

not unfrequent on the Neilgherries and Pulney mountains, but probably introduced with seed corn and has become naturalized. *Micropyxis* seems rare, I have only once found it. Duby does not seem to be aware that the plant he has described under the nane of *L. Leschenaultii* is Wallich's *L. Clementsoniana*, a name quoted by him among his *non satis notæ* species, that and the accompanying one being the only ones known on these hills.

Lysimachia deltoidea (R. W.), procumbent, extremities of the branches ascending densely pubescent, hairs jointed: leaves subsessile, opposite or whorled, ovate, obtuse, sparingly sprinkled on both sides with jointed pubescence: peduncles axillary, solitary, about the length of or exceeding the leaves; fructiferous ones reflexed: calyx lobes lanceolate, pilose, perforated with numerous translucent orange coloured glands: corolla rotate sometimes glanduliferous: filaments short, monodelphous at the base, anthers sub-triangular: seed hispid. Neilgherries, Pulney mountains, Ceylon. This species is nearly allied to L. nemorum but is certainly distinct.

EXPLANATION OF PLATE 144.

1. *Lysimachea deltoidea*, flowering branch, natural size.
2. Detached corolla and stamens.
3. Anthers.
4. Calyx and ovary.
5. Ovary cut vertically.
6. —— cut transversely.
7. Capsule full grown.
8. Capsule detached.
9. —— cut vertically.
10. —— transversely.
11. Placenta and seed detached.
12, 13. Seed upper and under surface.
14. —— cut transversely showing the embryo in situ.
15. Upper and under surface of leaves.

XCVI.—MYRSINEACEÆ.

This order was, almost unknown to Jussieu, the few genera he knew, appertaining to it, being referred to allied orders, *Myrsine* itself to *Sapotaceæ*. To Mr. Brown we are indebted for its first separation and limitation. Ventenant had previously indicated it as distinct from *Sapotaceæ*, but seems to have been imperfectly acquainted with its peculiarities. Since established and defined by Mr. Brown it has been retained by all Botanists. The latest writer on the subject, Alph. De Candolle, has thrown much light on its genera and species which, under his hands, have become very numerous; now amounting, according to Lindley's enumeration to 30 genera and 320 species, but he includes *Theophrasteæ* which D. C. separates as a distinct order. As an order its prominent characteristics are its bearing the stamens opposite the lobes of the corolla having a 1-celled ovary and a central free placenta covered with ovules immersed in alveolæ or sockets. They are nearly all shrubs or trees, and for the most part tropical, a few however extending nearly 20 degrees on either side of that zone. By these marks they are best distinguished from Primulaceæ which are nearly all herbaceous and extra-tropical.

Character of the Order. Flowers bisexual or sometimes unisexual. Calyx 4–5-cleft persistent. Corolla usually deeply 4–5-cleft, rarely 4 petaled, equal. Stamens 4–5 opposite the lobes of the corolla, into the base of which they are inserted; filaments distinct rarely connate sometimes wanting; anthers attached by their emarginate base, two-celled, dehiscing longitudinally. Ovary free, or partially adherent with a single cell and a free central placenta, in which is immersed the campulitropal ovules; style 1 short; stigma lobed or undivided. Fruit drupaceous or baccate, usually one-seeded sometimes with two or more. Seeds angular or sub-globose with a hollow hilum and simple integument. Albumen copious horny, of the same shape as the seed; embryo taper, usually curved, lying across the hilum when the seed is solitary or inferior, and touching the hilum when the seeds are numerous and lateral; cotyledons short. Trees or shrubs. Leaves alternate undivided, serrated or entire, coriaceous, smooth; stipules none: sometimes under shrubs with opposite or ternate leaves. Inflorescence in umbels, corymbs, or panicles, axillary or terminal. Flowers small, white or red, rarely yellowish. (Lindley slightly altered.)

Affinities. Under this head little can be added to what has been already said under *Primulaceæ*. The socketed placenta of *Myrsineaceæ* is noticed, but it would appear from

cases adduced among Primulaceæ, where a somewhat similar structure occurs, that no great weight can be attached to that circumstance. Habit and geographical distribution must, I apprehend, be looked upon, in this case, as the really essential distinguishing feature. The section, or according to Alph. D. C. the order, *Theophrasteæ* has alternate sterile stamens and extrose anthers as in *Sapotaceæ*, showing a transition from the one into the other and indicating a direct affinity between the two orders, which, however, are kept distinct by the difference of the ovary, which is several-celled in Sapotaceæ, and also by the very different structure of the seed. Whether or not *Theophrasteæ* ought to be separated from *Myriseneaceæ* is a question which scarcely comes within the scope of this work, there being no Indian species of the former, but, were I called upon to give an opinion, I think it probable it would be adverse to their separation partly on the ground of analogy furnished by Sapotaceæ, between the genera of which it appears to me there are as wide discrepancies as between *Theophrastaceæ* and *Myriseneaceæ*. But on the other hand many families, are less clearly defined and therefore it is my impression that the verdict of A. De C. will ultimataly be confirmed as it rests on some strong points.

Geographical Distribution. In 1833 when Alph. De Candolle's paper on this family was read in the Linnean Society, he was only acquainted with 180 species excluding *Theophrasta*, since then the number has been nearly doubled. In his three tabular statement of the geographical distribution of the order he assigns only 9 to "Ceylon and the Indian Peninsula," I cannot say how many I have, indigenous within these limits, but I am nearly certain the number is little under twenty.

I extract the following notice on this subject from my Spicilegium Neilgherriense—"This family is widely but unequally distributed, apparently preferring those countrics enjoying a rather high but equable temperature. They most abound in the Islands of the Indian Archipelago, next to which ranks Bengal, Burmah, and the Tenasseram coast. The Indian Peninsula and Ceylon, are placed low in the scale, whether owing to their possessing few or to these floras being less known, I do not know, but I know that I have in my own collection nearly twice as many as De Candolle assigned to both countries in 1833 when his very excellent paper was read to the Linnean Society."

Dr. Hooker in his "Botany of the Antarctic voyage," gives an admirable account of the geography of this family, which, though rather long, I am tempted to quote in full as a model of perfection.

"Myrsineaceæ are for the most part inhabitants of climates whose temperature is equable and they particularly abound in insular localities, as the Islands of the Indian Ocean, Mauritias, Bourbon and Madagascar. Their utmost Northern limit in the Old World seems to be the Azores, lat. 39° N., Madeira, lat. 32°, and Tenriffe; but in no part of the adjacent continent of Africa do they cross the Northern tropic; in Europe they are entirely wanting, and in Asia extend only to Japan in North lat. 40°. The order is very rare in N. America, and especially to the northward of Mexico, only one species inhabiting the United States, the *M. floridana*, A. De C., and that is confined to the southern state, whose name it bears, lat. 30° N. In the southern hemisphere they nowhere (except in New Zealand), are found to the southward of the 36th parallel, and there in S. Brazil only. In Africa they reach the 33d, and in Australia the 34th. Their extension into the 53d degree in the South Pacific Ocean, is hence a remarkable circumstance, and probably in some measure to be accounted for by the uniform temperature which the New Zealand Islands possess; further, they there bear a larger proportion to the other dicotyledonous vegetation than they do in any other part of the globe. I have alluded to the *Suttonia divaricata* having a considerable range in latitude, a circumstance not without parallel in the order to which it belongs. Of this, *Myrsine africana* is an extreme instance, that plant being found both at the Cape of Good Hope, in Abyssinia, and in the Azores. The species of the Natural Order are, however, as M. A. De Candolle well remarks (*Linn. Trans. vol.* xvii. p. 99), very confined as regards their geographical limits, *Melastomaceæ* and *Myrtaceæ*, being two of the very few groups containing about the same or a greater number of species which are more so."—*Jos. Hooker, Bot. of Antarctic Voyage*, p. 52.

Govindoo, del.

ADISIA POLYCIPHALA (WALL)

Dumoiy, Lith.

In addition to the above, it only remains for me to remark that generally they exhibit a decided prediliction for sub-alpine forests, which may in some degree account for their non-appearance on the African continent ; the interior mountains, having been as yet imperfectly explored and the same fact will, I think, account for so few having as yet been found in Ceylon and the Southern Provinces of India. Linnæus only knew one Indian species of the order, his *Samara læta*, De Candolle only 9 in 1833, and now my Herbarium has about 20 species, figures of 10 of which I have published.

Properties and Uses. On this head little is known, the fruit of some of the species possess considerable pungency and it is said, that those of *Embelia ribes*, which resemble black pepper are occasionally used to adulterate that article. The fruit of a species of Samara are called in Tamil 'Devil's pepper' indicating its possession of pepper-like properties.

Dr. Royle mentions that the fruit of *Embelia robusta* and *Myrsine bifaria*, are esteemed gently purgative by the inhabitants of that part of the country where they are indigenous. Upon the whole it appears, so far as present information extends, that they are deficient in active properties.

Remarks on Genera and Species. The order is divided into three very distinct groups by A. De Candolle, namely, *Mæseæ* having the ovary inferior and many-seeded fruit—*Embelieæ* ovary superior : corolla polypetalous—and *Ardisieæ* ovary superior : corolla monopetalous. The first of these contains one genus, the second two, *Embelia* and *Samara* (Choripetalum, D. C.), and the third 18, six of which have Indian representatives. Of these six, two only, *Myrsine* and *Ardisia*, so far as I am aware have been found in the southern provinces. These are distinguished at first sight by their inflorescence, in the former fascicled along the branches, in the latter more or less distinctly panicled or thyrsoid.

The genus *Samara* (Lin.), has long been an enigma. Dr. Arnott lately cleared up the doubts which hung over it by an examination of the original specimen. The genus was originally established on a specimen now actually existing in the Linnean herbarium, and was well defined, but the author, at the same time, quoted as a synonym, a figure which had no relationship with the plant before him. The plate being well known, but not the specimen, it in course of time came to be quoted as the authority for the genus and the original specimen of the plate being subsequently examined was found not to correspond with the generic character. This in place of suggesting the suspicion that Linnæus had merely committed an error in his synonym, was held as a proof that no such genus as he defined existed, and on that supposition A. De C. constructed his genus *Choripelalum* which, as shown by a comparison of the two generic characters, is identical with *Samara*, hence the latter, being the older name, must be retained to the exclusion of the other.

EXPLANATION OF PLATE 145.

1. *Ardisia polycephala* (Wall.), flowering branch, nat. size.
2. Flower-bud ready to expand.
3. Expanded flower.
4. Corolla detached and split open, showing the stamens opposite the lobes of the corolla.
5. Anthers back and front views.
6. Calyx and ovary.
7. Ovary detached.
8. Ovary cut vertically showing the free central placenta.
9. —— cut transversely.
10. A mature fruit.
11. The same cut transversely showing the solitary seed and remains of numerous aborted ovules; the embryo lying transversely across a copious horny albumen.
12. Embryo detached.

XCVII.—ÆGICERACEÆ.

There is a group of sea-shore plants, the Mangroves *(Rhizophoreæ)*, whose seed have the remarkable property of commencing germination before they quit the parent fruit. The species of this family are like them, sea-shore plants and like them the large seed (fig. 11) is not composed as usual, of large cotyledons and small radicle but of very small cotyledons on the apex of a greatly enlarged and germinating radicle.

This circumstance led Linnæus, on the authority of Rumphius, to suppose the species represented in the accompanying plate, a true *Rhizophora*, which he accordingly designated *R. corniculata.* Gærtner afterwards partly corrected the error, but himself fell into another, in mistaking the radicle for the cotyledons, which are concealed under the hood or calyptra shown in figs. 13, 14 and 15. Konig (Annals of Botany I. 129) advanced our knowledge of the peculiarities of this plant another step, by an excellent description and correct analysis of all its parts. These Brown confirmed and at the same time refered the genus to his order *Myrsineæ*, where most Botanists continue to place it.

In 1834 Blume (Annals des sciences) indicated it as forming the type of a distinct family, which view has been more recently adopted, after a most elaborate examination of the whole Mysineous group, by Alph. De Candolle, whom again I follow in viewing this order as distinct from *Myrineaceæ.*

The question may here be fairly mooted which of the two opinions is the right one. Paradoxical as such language may appear, I think, I am safe in setting out from the proposition that this is both an easy and a difficult question to answer. If we take enlarged views as to what constitutes an order, and construct them all somewhat on the principles which have guided Botanists, in the construction of such orders as Ranunculaceæ, Capparideæ, Leguminosæ, Rosaceæ, Rubiaceæ, Euphobiaceæ, &c. there can be then no question that *Ægiceraceæ* can only be viewed as a sub-order, but then *Primulaceæ* must be another. If Primulaceæ is kept distinct mainly on account of habit, we are surely not merely justified, but required to separate Ægiceraceæ in which we find distinctions drawn from both habit and structure. In regard to habit we find the one growing constantly in salt marshes, and germination commencing before the seed drops from the plant, while the rest of the order are comparatively inland in their predelictions. As regards structure, the filaments are united at the base, the anthers are alveolar with the pollen lodged in cells, like that of *Rhizophora* and *Viscum*, the placenta is not alveolate, the fruit is follicular, the Embryo is erect not transverse, and finally the seeds are without, albumen. To set against these, the stamens are opposite the lobes of the corolla and the placenta free, as in *Primula*, *Myrsine*, *Ardisia*, *&c.* The grounds for separation, it will then be seen preponderate unless we constitute "stamens opposite the lobes of the corolla, placenta central free," the essential character of the order and rigidly adhere to it. In that case *Primulaceæ*, *Myrsineaceæ*, *Ægiceraceæ* and perhaps *Theophrastaceæ*, will form sections of but one order, but if we are to separate *Primulaceæ* we must in consistency equally remove both *Ægiceraceæ* and *Theophrastaceæ.* Let Botanists construct their orders on a wider base, view them as natural orders, not as exagerated genera, and then we shall have fewer occasions for complaint of excessive multiplication, construct this order on the broad basis of "stamens opposite the lobes of the corolla, ovary one-celled, placenta central free," and the whole is brought together and kept there, after which the different parts can be conveniently distributed in groups for more easy study. That rule has not been applied in the case of *Primulaceæ*, so neither ought it to be in that of *Ægiceraceæ* and *Theoprastaceæ.*

This is my reason for following Blume and D. C. on this occasion, in opposition to all other Botanical authorities. It would be inconsistent to do otherwise, but at the same time I repudiate this hair splitting system in our higher groups, as having a tendency rather to impede than advance science, by breaking down on, apparently, insufficient grounds great natural families. Assuming that this synthetic process was applied to the group of plants brought together by the above characters. They might then be distributed into the following sub-orders.

Govindoo, del. Dunphy, Lith.

ÆGICERAS MAJUS (GÆRTER)

1. Primuleæ distinguished by their herbaceous habit and capsular fruit, as at present.

2. Mæseæ, including Samolus, marked by their inferior ovary, and being partly composed of herbaceous partly of woody plants, would form the transition to

3. Mysineæ, woody, primulaceous plants with drupaceous fruit.

4. Ægicereæ, woody, with alveolate anthers, exalbuminous seed and follicular fruit.

5. Theophrasteæ with alternate sterile stamens and extrorse anthers—leading into Sapotaceæ, and at the same time completing the Myrsineous circle. Many cases undoubtedly occur where it is quite impossible to follow such a course, but in all cases where it can, I certainly think it ought to be, and this is one of them.

Character of the Order. Calyx 5-parted, imbricato-convolute to the left in æstivation. Corolla 5-cleft, imbricato-convolute to the left in æstivation. Stamens 5, attached to the base of the corolla; filaments united at the base into a short tube; anthers versatile, 2-lobed, at the base, opening longitudinally, pollen lodged in a double row of cells or alveolæ. Ovary free, fusiform, 1-celled; central placenta ovoid, shortly stipitate; style filiform, persistent; stigma acute. Ovules numerous, not immersed in the placenta, all except 1, aborting, but persistent; the fertile ovule rapidly growing after the fall of the corolla, long-ellipsoid, exceeding the dry compressed placenta. Shortly after the ovule begins to germinate at the base, the elongation of the radicle stretches the stipe of the placenta, which finally becomes the apparent, but false funiculus, while the persistent placenta forms the hood covering the cotyledons at the apex of the mature seed. Seed exalbuminous, curved; embryo cylindrical, curved, thick; radicle inferior, sulcated. Pericarp elongated, arched, without nerve or suture, longitudinally striated, somewhat fleshy within, punctuate with resinous matter, at length splitting lengthwise on one or both sides.—Small trees or shrubs inhabiting salt marshes near the sea coast. Leaves alternate, exstipulate, coriaceous, entire, obtuse, marked with minute depressed points. Flowers usually umbelled, white, fragrant.

Affinities. On this head I have nothing to add in this place. De Candolle observes that they "principally differ from Mysineaceæ in their follicular fruit, want of albumen, elongated almost anatropous seed, germinating within the sheath and, perhaps, from all other plants by the great lengthening of the stipe of the central placenta during maturation; and lastly by the cells of the anthers transversely divided." In this last respect they do not seem to me to differ materially from *Rhizophora* and *Viscum*, in both of which the pollen is lodged in cells or alveolæ, the same as here.

Properties and Uses. Nothing known.

Geographical Distribution. Widely distributed over the tropics in salt marshes near the sea shore. Natives of both coasts of the Indian peninsula, the whole of the Malayan Archipelago as far as Java, New Holland, New Guinea. But I find no notice of the genus in Africa and a very doubtful one of its existence in America.

EXPLANATION OF PLATE 146.

Ægiceras majus—flowering branch, natural size.

1. A young flower-bud showing the convolute æstivation.

2, 3. Flowers in different states of expansion.

4. Corolla detached, and opened to show the filaments cohering at the base.

5. Anthers, back and front views.

6. Calyx opened to show the ovary and style after the fall of the corolla.

7, 8. Transverse and horizontal sections of the ovary.

9. Ovary cut open shortly after the fall of the corolla, showing the enlarged fertile ovule, and numerous aborted ones on the placenta.

10. The ovule more advanced, the elongation of the stipe of the placenta commenced.

11. Full-grown seed.

12. The seed cut transversely after germination has commenced, the centre sublignious, the circumference corticose.

13. Seed in situ.

14. Removed from the follicle.

15. Calyptra detached, showing the cotyledons.

XCVIII.—SAPOTACEÆ.

This order, as first established by Jussieu, contained 9 genera, two of which have since been excluded; it now embraces 21, and above 200 species. Of these Alphonse De Candolle, in his recent revision, added several genera, and many hitherto undescribed species. The order, for the most part, consists of trees and shrubs, abounding in milky juice, generally natives of tropical countries in both the Old and New World. One of its most striking peculiarities is found in the flowers, in which, with the exception of 2 or 3 genera, is found a series of petaloid appendages or sterile stamens, alternate with the fertile ones. These appendages are placed next the clefts of the corolla, the true stamens opposite the lobes, as in *Myrsineaceæ*, but with the anthers extrorse—that is opening outwardly towards the petal, in place of inwardly towards the pistil. The fruit, which in some species is large, has some resemblance to an apple, a likeness sometimes even more apparent after being cut than before, owing to the star-like form of the cells. That of several is edible, and a few most delicious, among which I would place the Sappodilla plum.

Character of the Order. Caylx 5- or occasionally 4–8-lobed, valvate or imbricate in æstivation. Corolla monopetalous hypogynous, regular, deciduous, its segments usually equal in number to those of the calyx, seldom twice or thrice as many, imbricated in æstivation. Stamens inserted on the corolla, distinct; usually partly fertile partly sterile, the former equaling the number of lobes and opposite them, the latter alternate, sometimes twice as many, rarely all fertile; anthers extrorse. Ovary superior, several-celled, cells usually opposite the lobes of the calyx, with a single erect or suspended ovule in each; style one; stigma undivided or occasionally lobed. Fruit fleshy with several one-seeded cells, or, by abortion, only one. Seeds nut-like, sometimes adhering into a several-celled putamen; testa bony, shining, with a long scar on the inner face; embryo erect, large, white, usually enclosed in fleshy albumen; cotyledons, when albumen is present, foliaceous, when absent, fleshy and sometimes connate; radicle short, straight, or a little curved, turned towards the hilum.—Trees or shrubs natives of the tropics often abounding in milky juice. Leaves alternate or almost whorled, entire, coriaceous. Inflorescence axillary. Flowers hermaphrodite.

Affinities. This order seems very appropriately placed between the Myrsineous group and *Ebenaceæ*, having the flowers of the former, i. e. the fertile stamens opposite the petals, but with the addition of intermediate sterile ones—agreeing also in their soft juicy wood: while on the other hand, they have the many-celled ovary with solitary ovules of the latter. The corolla, also, of both, is in many instances similar. But while these 3 families seem almost insensibly to pass into each other, they are all essentially distinct. So distinct indeed that Lindley places them in three separate alliances. I am scarcely prepared to follow him so far, but still there can be no doubt of the wide difference between a Sapota and an Ebinus, though in botanical characters they seem so nearly allied. But even as regards these they are amply distinct, both from each other, and from all other monopetalous orders. Lindley places *Sapotaceæ* in his Rhamnal alliance and associates with them apetalous and polypetalous flowered orders, some with and some without albumen, but, I believe, sparing in all. The connection between *Sapota* and *Ulmus* I confess I cannot trace, neither do I see very clearly that between this family and *Hippocrateaceæ*, or I may almost say any other order of the alliance. But in this the fault may lie with me. In the meantime, however, I view the association in which it is here placed, as preferable to that in which he has located the family.

Geographical Distribution. Endlicher, in his Enchiridion Botanicum, gives the following brief summary. "Found within the tropics of the whole world, in sub-tropical regions in Australia, the Cape of Good Hope, Northern and Western Africa, and the warmer parts of North America; more rarely in South America." The number of Indian species is inconsiderable, scarcely amounting to 30 in all. Those from South America I believe exceed that number. In Madagascar, the Mauritius, and Isle of Bourbon, they are more numerous. Of the Indian

ones three are found high on the Neilgherries, and one of them, *Sapota Elengoides*, near the summit; it is certainly very common about Ootacamund at an elevation of 8,000 feet. Two species of *Isonandra* occur, one in the forests about the Avalanche, the other on the slopes below Sysparah. In the forest at the foot of that pass I found, but only in fruit, a species of *Bassia*, much resembling *B. longifolia* but apparently quite distinct. The leaves are nearly twice the length of those of *B. longifolia.*

Properties and Uses. On this head a good deal might be said as almost every species has had some useful property assigned to it. Several of the foreign species are said to be endowed with properties resembling those of Cinchona. The seed of the Bassias furnish oil, and a substance much resembling butter, in considerable quantities; that of the former is partly consumed for burning but more extensively in the manufacture of country soap which, I believe, owes its peculiar heavy disagreeable smell to this ingredient. Roxburgh has published an account of the Butter tree, Bassia butyraceæ, in the Asiatic Researches, the substance of which I quote from Royles' Illustrations, not having the original at hand: "But the most remarkable produce is that of the Fulwa or Phulwara, the Butter or Ghee tree of the Almora and Nepaul hills, which is of a delicate white colour, and of the consistence of fine lard, but without any disagreeable smell; it is highly esteemed as a liniment in Rheumatism, contraction of the limbs, &c., and when used by natives of rank is frequently impregnated with some fragrant *atr*. The tree very much resembles *B. latifolia*, but may be distinguished by its much less fleshy corols and more numerous stamens. It grows on the southern ascent of the Almora hills, flowering in January and ripening its fruit in August. The kernels, about the size and shape of almonds, are easily extracted from the smooth chesnut-coloured pericarps, when they are bruised and rubbed up to the consistency of cream, and subjected to a moderate pressure in a cloth bag. The oil concretes immediately it is expressed, and retains its consistency at a temperature of 95° (Roxb. As. Res. viii.)." In addition to these valuable products the timber of these trees is considered valuable; the fleshy corollas, which fall in vast numbers when the trees are in flower, are picked up and used as esculents, either dried, or at once stewed and made into curry. Others are fermented and a potent spirit extracted by distillation. The fruit of Mimusops Elengi are eat by the natives, while the flowers are prized on account of their delightful fragrance. The bark, which is astringent, is said by Dr. Royle to be used in medicine, a fact which Dr. Ainslie seems not to have been aware of, as it is not included among his medicinal plants. The fruit of *Sapota Acras*, the sappodilla plum, a tree introduced into India, is most justly prized as a great delicacy, while that of the native species, *Sapota Elengoides*, is more austere than the worst of crabs, which, by the way, it a good deal resembles. On the Neilgherries, where it abounds, the natives pickle it, as a condiment for their currys, a proof that they are easily pleased. The most valuable product of the order is the recently discovered *Gutta percha*, the produce of a species of *Isonandra*, (*J. Percha* Hooker), a genus first established on two Indian plants in my collection, to which three more, all Indian, have since been added, the properties, however, of none of which have yet been investigated. The Indian division of the genus differs from the Phillipine one in having tetramerous flowers while it has them hexamerous. In other respects they seem to associate as members of the same genus, but their properties may equally differ like their flowers.

Remarks on Genera and Species. De Candolle gives the following summary of the generic characters, which seems very clear, and may prove useful in enabling readers who may not have that work at hand to refer specimens to their proper genera.

1. "No sterile stamens or appendices to the corolla. *Chrysophyllum.*
2. Simple sterile stamens or appendices, opposite the divisions of the corolla and alternate with the fertile stamens. *Sapota, Sideroxylon.*
3. Stamens all fertile, double the number of the lobes of the corolla. *Isonandra.*
4. Lobes of the corolla in pairs before the lobes of the calyx, stamens all fertile, opposite the lobes of the corolla. *Bassia.*
5. Lobes of the corolla in pairs before the lobes of the calyx, with an interior petaloid verticel opposite the lobes of the calyx: fertile stamens opposite the interior petals and calyx, with alternate sterile ones. *Mimusops.*

Examples of some of these are given in the supplementary plate 147 *b*. Of the series, the most difficult to understand is *Mimusops*. The flower of this genus is very complex. It consists of two rows of sepals, of two series, or whorls, of lobes to the corolla. The outer series has twice as many lobes as there are sepals, or lobes to the calyx (12 or 16), these are arranged in pairs alternate with the midribs of the sepals; within is a second series equaling the number of sepals and opposite their midribs: opposite these stand the fertile stamens, and alternate with them the sterile ones. The arrangement may be thus illustrated. Let S stand for sepal, C for corolla, a for anther, or fertile stamen, and f for the petaloid sterile filament. Then let us take an 8-partite species, say *Mimusops Elengi*, as being most common, for the example, though that is not constantly 8 as I have repeatedly found decandrous flowers on the same specimen with octandrous ones.

S S S S
S S S S
C C C C C C C C C C C C C C C C
C C C C C C C C
a f a f a f a f a f a f a f a f

This is a rude but sufficiently expressive diagram and one easily given and understood. It would be still better shown by five concentric circles intersected by transverse lines.

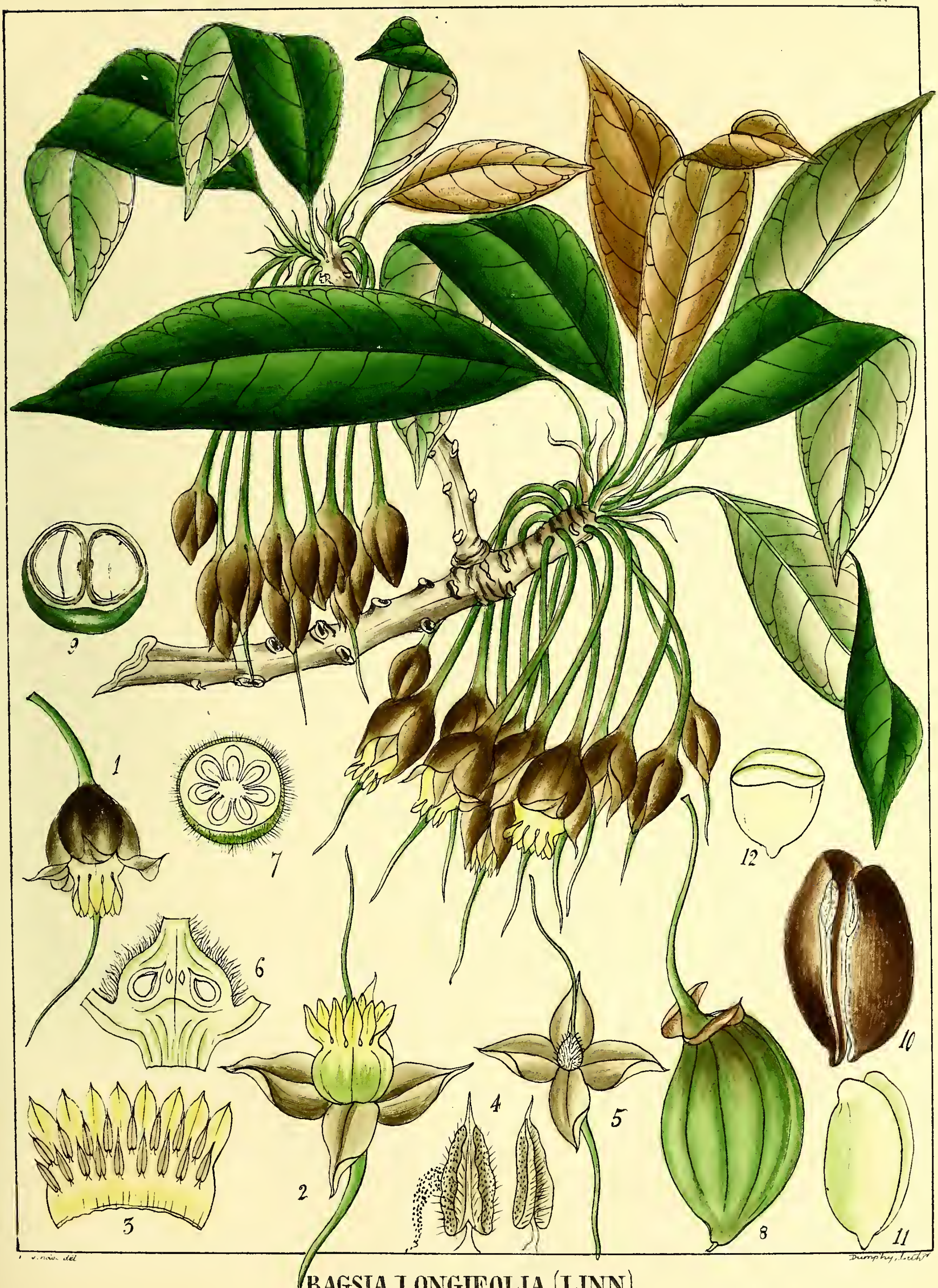
As stated above the number of parts of the flower of *Mimusops* is liable to vary. In *M. Elengi* I have not seen fewer than 8 parts to the whorl, but often 10 and even 12. In *M. hexandra* octandrous flowers are of frequent occurrence, but I have not yet seen more. De Candolle's division into 8-androus and 6-androus species must, therefore, be received with some degree of latitude. I had very nearly referred a specimen of the latter form, having 8-androus flowers mixed with hexandrous ones, as a new species to the octandrous section, and probably would have done so, had I not given it to the draftsman to make a drawing, when he fortunately stumbled on a hexandrous flower, which led to more minute examination and showed that the two forms were mixed on the same branch, in the same way as I had already seen in *M. Elengi*. The tree however proves a new species, nearly allied to hexandra, from which it differs in having short petioles and long pedicels, the very reverse of what they are in the original species, and globose, 3 to 6-seeded fruit, not oblong like an olive, as shown in Roxburgh's figure. In regard to that figure it may be observed that it appears to be made up of two species, the branch belonging to one and the dissected magnified flower to another. The former seems to accord in its characters with *M. indica* (D. C.), the dissected flower with those of my new species, which I have named *M. Roxburgiana*, and given its analysis, figure C. of Plate 148. b. De Candolle remarks under *M. hexandra*, "Inter plantas a cl. Wallich comm. specimen iconi conforme non vidi. An errores in icone." A comparison of my Icones Nos. 1587–88 with Roxburgh's Cor. Pl. tab. 15, may possibly explain the cause of this nonconformity by showing that Roxburgh's plate is in all probability taken from the two plants represented in these plates, the flowering branch and fruit belonging to the one, the magnified flower to the other.

In regard to the fact mentioned above, of the liability of species of *Mimusops* to vary in the number of parts of their flowers, I have observed the same thing in the ovary of *Isonandra Condolliana*, different flowers from the same fascicle having some 4 some 6 cells.

EXPLANATION OF PLATE 147.

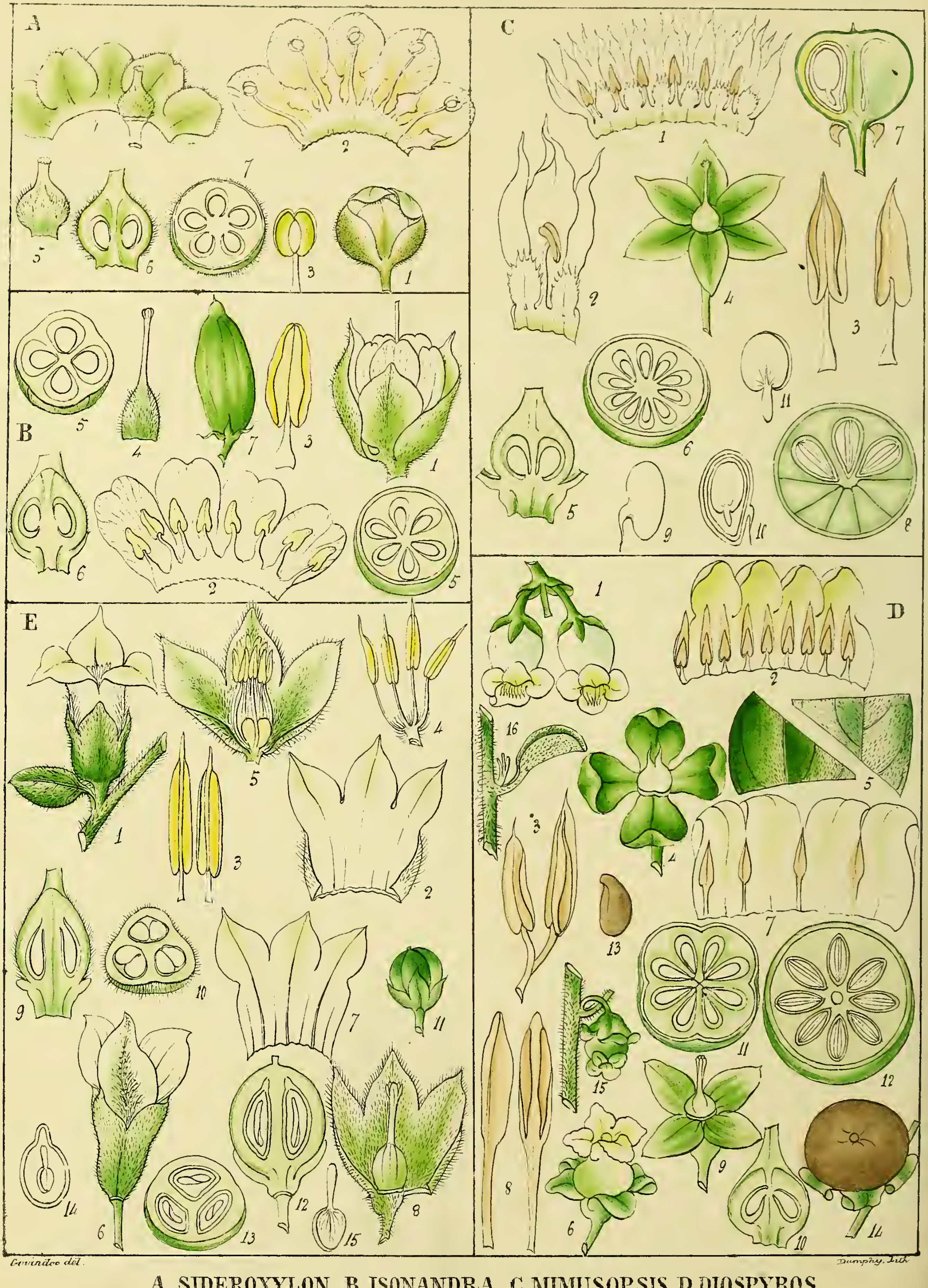
Bassia longifolia, flowering branch.

1. Detached flower, natural size.
2. Same with the calyx opened to show the tube of the corolla.
3. Corolla split open, showing the stamens in situ.
4. Anthers, back and front views.
5. Ovary and style, after the fall of the flower.
6. Ovary cut vertically, ovules pendulous.
7. —— cut transverely, in this instance 7-celled.
8. A fruit nearly full grown.
9. —— cut across all the seed except 2 aborted.
10. Detached seed.
11. Cotyledons, testa removed.



Dumphy, Lith.

BAGSIA LONGIFOLIA (LINN)



A. SIDEROXYLON. B. ISONANDRA. C. MIMUSOPSIS. D. DIOSPYROS.

E. MABA.

EXPLANATION OF PLATE 148–b. partly.

A. *Sideroxylon Attenuatum.*

1. Flower bud.
2. Flower split open, showing the fertile and sterile stamens. 3. Anthers.
4. Calyx divided, showing the free ovary.
5. Ovary detached. 6. cut vertically, ovules ascending.
7. Cut transversely, 5-celled.

B. *Isonandra Candolliana.*

1. A detached flower.
2. Corolla detached and split open, showing all the stamens fertile and anthers extrorse.
3. Detached anthers.
4. Ovary detached.
5. and 5. Two ovaries cut transversely, one 4- the other 5-celled.
6. Cut vertically.

C. *Mimusops Roxburghiana.*

1. Expanded flower.
2. Detached corolla split open.
3. A portion of the corolla more magnified, showing all the parts mentioned in the diagram.
4. Detached stamens.
5. Calyx and ovary.
6. Ovary cut vertically.
7. Cut transversely.
8. A fruit cut vertically.
9. —— cut transversely, 5 of its 8 ovules abortive.
10. Detached seed.
11. —— cut longitudinally, embryo in situ.
12. Detached embryo.

XCIX.—EBENACEÆ.

This small order, consisting of only 8 genera, but nearly 160 species, was first indicated by Jussieu under the name of *Guaicanæ*, to which he referred 10 genera, all except two of which have since been removed; one to *Sapotaceæ*, and seven to *Styracaceæ*. Ventenat and Brown subsequently revised the order, the former changing the name to that which it now bears. It for the most part consists of trees, the timber of which is remarkable for its hardness and durability, the well-known Ebony and Lignum Vitæ being two of them.

Character of the Order. Flowers, by abortion, usually unisexual rarely bisexual, the male with a rudimentary ovary, the female with sterile stamens. Calyx 3–7-lobed, nearly equal, persistent. Corolla monopetalous, somewhat coriaceous, usually pubescent externally and glabrous within; limb 3–7-lobed, imbricated in æstivation. Stamens definite, either arising from the corolla, or hypogynous, twice as many as the segments of the corolla, sometimes four times as many, or the same number and then alternate with them, often inserted in pairs near the bottom of the tube and those neither opposite nor alternate; filaments simple in the hermaphrodite species, generally doubled in the polygamous and diæcious ones, both their divisions bearing anthers but the inner generally smaller; anthers attached by their base, generally lanceolate, 2-celled, dehiscing lengthwise, sometimes bearded; pollen round, smooth. Ovary sessile without any disk, several-celled, the cells each having one or two ovules, pendulous from the apex; style divided, seldom simple; stigmas bifid or simple. Fruit fleshy, round, or oval, by abortion often few-seeded, its pericarp often opening in a regular manner. Seed with a membranaceous testa, of the same figure as the albumen, which is cartilaginous and white; embryo in the axis, or but little out of it, straight, white, generally more than half as long as the albumen; cotyledons foliaceous, generally somewhat veiny, lying close together, or occasionally slightly separate; radicle taper, of middling length or long, superior, turned towards the hilum.—Trees, shrubs, or undershrubs, without milk, with hard heavy wood, frequent in warm, rare in colder regions. Leaves alternate or sub-opposite, entire, exstipulate, short petioled. Cymes axillary, rarely terminal, in the males few or many-flowered, one flower evidently terminal; in the female one-flowered by the lateral flowers aborting; pedicels articulated at the apex; females usually larger, with the calyx growing with the fruit.

Affinities. Jussieu viewed the genus *Diospyros* as being most nearly allied to *Sapota*, but included it in an order the bulk of which was composed of genera now removed to constitute the present *Styracaceæ*, which are perigynous or have an inferior ovary, hence, misled by that association, he placed *Diospyros*, having hypogynous flowers, in his perigynous class, from which it is sufficiently distinct. Brown considers this order most

nearly related to the Olives (Oleaceæ), though quite distinct. De Candolle remarks that it approaches *Sapotaceæ* on the one side, in the position of the stamens and form of the fruit, and *Oleaceæ* on the other, through the genera having two pendulous ovules. Its nearest affinity, however, as long ago indicated by Brongniart, is clearly with the Hollies *(Ilicineæ)*, into which they almost pass, the distinguishing characters being of only secondary value. Lindley considers that their nearest affinity is with *Ilicineæ* on the one hand, and *Apocynaceæ* on the other. This last relationship I find myself unable to trace, but see little difficulty in the other; they seem indeed to pass by an easy gradation through *Ilicineæ* into *Oleaceæ;* but to my mind the relationship between *Ebenaceæ* and *Sapotaceæ* is not so close though evident enough, neither can I quite agree with Endlicher in thinking that there is scarcely any difference between them and *Styracaceæ* except the difference in the insertion of the corolla.

Geographical Distribution. Tropical Asia and the Cape of Good Hope, seem to be the two principal centres of this family, but many are also natives of the Mauritius and Madagascar, also several of New Holland and South America. One is found in Europe and another in Virginia. From this it appears that the family is in a great degree tropical in its habits.

Properties and Uses. Under this head there is little scope for remark. Among the Indian species none are mentioned as possessed of medicinal properties. The wood of all is esteemed for its extreme hardness and durability, in many it is nearly quite black, of which the Ebony is a well known example; that of *Diospyros montana* is varigated with black and white veins. The fruit of *D. glutinosa* is distinguished for having a glutinous astringent juice, which the natives of Bengal use for paying the bottoms of boats and dressing their fishing nets, to preserve them from the effects of the water. The fruit of *Maba buxifolia* are edible—the taste is sweetish and not unpalatable, but scarcely worth the trouble of eating, the seed being so large in proportion to the pulpy portion.

Remarks on Genera and Species. The genera of this order are few in proportion to the species and so far as the Indian members of the family are concerned of easy discrimination. I am myself only acquainted with two of the 8 genera, and analyses of both will be found in Plate 148–*b*. *Diospyros* has the flowers 4–5- or 6-lobed with the proportion of parts in conformity. *Maba* has them 3-lobed. Of *Diospyros* the Indian flora presents a list of nearly 40 species, of *Maba*, so far as De Candolle's Monograph shows, only one, to which I have recently added a second from the Neilgherries, the analysis of which, male and female, is given. Regarding the species of Diospyros I cannot venture to offer any remarks, as in truth I do not understand them, and my collection is not sufficiently perfect to admit of my attempting any improvement on the skilful labours of Alph. De Candolle, who seems to have bestowed much care on their elucidation; but the genus is truly a difficult one, owing to the separation of the sexes too often rendering it incumbent on the Botanist to deal with only half a species. The species selected for the illustration of the genus is, I believe, correctly named as it seems perfectly to correspond with both the figure and description of Roxburgh in every thing except the fruit, which in my specimens are not quite mature, which may account for the difference.

EXPLANATION OF PLATE 148.

Diospyros cordifolia, flowering branches natural size.

1. Male. 2. Female.

Govindoo, del. Dumphy lith

DIOSPYROS CORDIFOLIA (ROXB)

EXPLANATION OF PLATE 148–b. partly.

D. *Diospyros cordifolia.*

1. Cyme of male flowers.
2. Corolla split open, the stamens in situ, in this instance 9 pairs, 8 however is the usual number.
3. A pair of anthers detached.
4. Calyx and sterile ovary.
5. Portions of upper and under surface of the leaf, slightly magnified to show the pubescence.
6. Female flowers.
7. Corolla opened, sterile filaments in situ.
8. Detached sterile filaments.
9. Calyx and ovary.
10. Ovary cut vertically, ovules pendulous.
11. —— cut transversely, 4-celled with two collateral ovules in each.
12. A fruit, immature.
13. —— cut transversely, not sufficiently mature to admit of perfect dissection of the seed.
14. A small portion of a branch magnified, to show the pubescence.

E. *Maba Neilgherrensis*, (R. W.)

1. Male flower.
2. Corolla detached and opened.
4. Detached stamens.
5. Calyx opened, the stamens (9 in this case) inserted round the base of the sterile ovary.
6. Female flower.
7. Detached corolla.
8. Calyx split open, to show the ovary in situ.
9. Ovary cut vertically.
10. —— cut transversely, 3-celled with two ovules in each.
11. An immature fruit.
12. —— cut vertically.
13. —— cut transversely.
14. Seed divided longitudinally, embryo in situ.
15. Embryo detached.

C.—ILICINEÆ.

This order is one of comparatively recent date, the genera composing it having, previous to their separation by Brongniart in 1826, been associated with those of *Rhamneæ* and *Celastrineæ*. In 1825 D. C. constituted them a tribe of his order *Celastrineæ*, under the name *Aquifoliaceæ*, from an old generic name of *Ilex*, which, however, he did not retain as an authority for his tribal designation and, in so far I believe, departed from his own rules of nomenclature. But be that as it may, it appears that nearly all Botanists think so, as Lindley and Meisner seem to be the only ones who adopt that as the ordinal name. My sentiments quite coinciding with those of the majority, I adopt the name under which the order, as an order, was first defined and limited. It has 11 genera assigned to it in the most recent lists, but no fewer than six of those have a mark of doubt added, indicating that they may not properly belong to it, and two of the remainder seem to me to constitute but a single genus, the differences between *Ilex* and *Prinos* being of specific value only; *Ilex* having the corolla 4–5-lobed, *Prinos* six-lobed; in all other respects they are the same. Hence both *Ilex Garderiana* and *I. Wightiana* unite within themselves both genera, these species having as often 6 as 5 lobes to their corollas, and cells to their ovaries. *I. denticulata*, according to these definitions, is a true Ilex, except that it is very generally polygamous, which, according to the character, it ought not to be.

The species consist of Evergreen trees and shrubs of which the common English Holly (Ilex aquifolium) is the type, with the exception of the leaves, it being about the only one of the 60 or 70 species in which they are so strongly armed with lateral spines. The leaves of the only Indian ones with which I am acquainted have not a trace of them.

Character of the Order. Flowers small, white or greenish, axillary, solitary or clustered, sometimes unisexual by abortion, sepals 4–6, imbricated in æstivation. Corolla 4–6-parted, hypogynous, imbricated in æstivation. Stamens inserted on the corolla, alternate with its segments; filaments erect; anthers adnate, two-celled, opening longitudinally. Disk none. Ovary fleshy, superior, somewhat truncate, with from 2 to 6 or more cells; ovules solitary, anatropal, pendulous, and often hanging from a cup-shaped funeculus; stigma subsessile, lobed. Fruit fleshy, indehiscent, with from 2 to 6 or more stones. Seed suspended, nearly sessile; albumen large, fleshy; embryo small, 2-lobed, lying next the hilum, with minute cotyledons, and a superior radicle.—Evergreen trees or shrubs, whose branches are often angular. Leaves alternate or opposite, simple, coriaceous, without stipules. Lindley.

Affinities. On this point considerable difference of opinion exists. Jussieu and D. C. and Endlicher associate this order with the Celastrineous group among calyciflore, most Botanists however agree with Brongniart in placing it among the corolliflorous orders, as being related to *Sapotaceæ* and *Ebenaceæ* on the one side, and *Oleaceæ* on the other, a view in which, it appears to me, they are well borne out by both habit and structure. Lindley, after in the main adopting Brongniart's view, as to their near relationship with *Ebenaceæ*, goes on to remark : "Their true character resides in their monopetalous corolla, axile placenta, pendulous, definite seeds, and minute embryo lying in the base of a fleshy albumen. They differ from *Loganeaceæ* in the want of stipules, from *Aporynaceæ* in their simple stigma, and from *Ebenaceæ* in their long style, the stigmas of which never have a radiating appearance ; in their want of the peculiar silky corolla with a twisted æstivation ; in their stamens being constantly definite in number, and in the still more minute size of the embryo."

Geographical Distribution. The species of this order are extensively but sparingly distributed; eight or ten are natives of India. In the West Indies, South America, and the Cape, they are more numerous. Several are found in North America, and one in Europe.

Properties and Uses. On this head, so far as the Indian species are concerned, nothing is known. Several species possess tonic and astringent properties, while the fruit of some are said to be purgative and emetic, and it is asserted that the leaves of the common holly are equal to Peruvian bark in the cure of intermittent fever, which may, I think, be safely doubted even though a celebrated German physician (Reil) affirms that he had employed both them and the bark successfully, in cases of Epidemic Intermittent, where Cinchona had failed. The bark of the holly is known to furnish bird-lime, a fact to which I can myself testify, having often, when a boy, prepared it, sometimes by the very primative operation of mastication, at others by bruising the bark between stones and washing out the parenchymatous matter. It is not improbable the species figured here may, by similar treatment, furnish that curious substance, as it belongs to the same group with the true holly. But the most curious property of the family is found in the Paraguay or Matè tea, a full account of which, from the pen of Sir W. Hooker, has been given in the London Journal of Botany, vol. i. p. 30. The following extract from that paper, regarding the properties of that drug, and the effects on the human constitution of that beverage, may be interesting.

"Many and highly various, nay contradictory, are the virtues which the South Americans fondly attribute to this, their favourite drink. It is certainly aperient and diuretic ; but its other qualities are more problematical ; though, to individuals who accustom themselves to it, the habit becomes second nature ; and to break off, or even to diminish the quantity is almost impossible. Like opium, it certainly seems to rouse the torpid and calm the restless ; but, as in the case of that noxious drug, the immoderate use is apt to occasion diseases, similar to those consequent on the practice of drinking strong liquors. Persons who are fond of it consume about an ounce per day. In the mining countries, the *matè* is almost universally taken, from the opinion that prevails among the Spaniards that the wines there are prejudicial to health ; but the Creoles throughout South America are passionately addicted to this beverage, and never travel without a supply of the leaf, which they infuse and imbibe before each meal, and sometimes much oftener, never tasting food unless they have first drunk their matè." Theine, the alkaloid of Tea and Coffee, has been detected in its leaves. According to Martius, other species are also employed in the same manner in Brazil, and he further states that the unripe fruit of one species abounds in tannin, and, being bruised in ferruginous mud, are employed in dying cotton fabrics ; they act like galls.

Remarks on Genera and Species.—In a family where we have only one genus and three species, there is not much scope for remark. Two genera have however been formed where one is enough. *Ilex* is said to have a 4–5-lobed calyx and corolla, and as many stamens and cells to the ovary as there are lobes in the corolla ; while *Prinos* is said to have six parts throughout. Of the three species indigenous to the Indian peninsula, two have five or six parts

Govindoo del. Dunphy, Lith.

ILIX (PRINOS) DENTICULATA (WALL)

and one four. The last therefore is certainly an *Ilex*, but what are the other two? Had the characters been 4 to the one, and 5 or 6 to the other I should have felt constrained, so far as our flora shows, to have admitted both genera, but as it is no uncommon occurrence to find 5- and 6-lobed flowers on the same branch, and of course *Ilex* and *Prinos* on the same tree, it seems an unnecessary division. I have therefore united the two and refer the whole to Ilex: *I. denticulata* being quaternary the other two quinary or senary, mere specific differences.

EXPLANATION OF PLATE 149.

Ilex denticulata.

1. Flowering branch, male plant, natural size.
2. Detached male flowers.
3. Corolla opened, showing the stamens.
4. Detached stamens, back and front views.
5. Abortive, ovary and calyx.
6. Portion of a branch of a bisexual tree.
7. Cluster of fertile flowers, natural size.
8. Detached corolla.
9. Detached stamens.
10. Detached ovary and stamens.
11. Ovary, cut transversely.
12. —— cut vertically.
13. A cluster or ripe fruit.
14. A berry, cut transversely.
15. A detached seed or nut.
16. Seed cut longitudinally.
17. —— cut transversely.

CI.—STRYRACACEÆ.

The genera of this order, so far as known to Jussieu, were associated by him with *Ebenaceæ*. These were subsequently separated to form a distinct order, under the name of *Styraceæ*, by Richard, which all subsequent Botanists have retained, under different names, that above given being the one now generally adopted, *Styraceæ* being retained for one of its sections. The order is of considerable extent, including about 120 species, but only six genera. Most of them are handsome flowering trees or shrubs, generally natives of tropical or subtropical countries, but not yet observed in New Holland.

Character of the Order. Calyx adherent to the ovary, persistent, 5- (or 4-) lobed; lobes imbricating in æstivation. Corolla monopetalous, the number of its lobes frequently different from those of the calyx (in the Indian species both usually 5) with imbricated æstivation, stamens definite or indefinite, arising from the tube of the corolla, of unequal length, cohering in various ways, but generally in a slight degree only, round the throat of the tube; anthers, 2-celled, bursting inwardly; pollen broadly elliptical, smooth. Ovary adhering to the calyx, rarely free, from 2- to 5-celled, cells opposite the lobes of the calyx, when the same number, the partitions sometimes scarcely adhering in the centre; ovules anatropal, 2 or several in each cell, either all pendulous, or the upper one ascending; style simple; stigma somewhat capitate. Fruit drupaceous, enclosed in the persistent calyx, generally with all the cells, except one, abortive. Seeds ascending or suspended, with the slender embryo lying in the midst of the fleshy albumen; radicle long, directed to the hilum; cotyledons flat.

Affinities. On this point considerable difference of opinion exists. Jussieu, as already remarked, referred all those he knew to *Ebenaceæ*, and most subsequent Botanists, in adopting the order, have generally coincided in viewing it as very nearly allied, and perhaps I may add, as owing its separation as much to the adherent ovary as to its other characters. Mr. Bentham indicates "their alliance with *Ebenaceæ* amongst *Monopetalæ*, and with *Humeriaceæ* in the first instance, and in the next place, with *Meliaceæ* and perhaps with *Aurantiaceæ* and *Olacineæ*, amongst *Polypetalæ*." Endlicher and De Candolle coincide in these views, all three expressing their belief in the near relationship existing between *Styracaceæ* and *Ebenaceæ*. Lindley dissents, observing that "those Botanists who attach paramount importance to the condition of the corolla, in deciding upon the relationship of plants, will object to the station now occupied by Storaxworts *(Styracaceæ)* which, because of a slight adhesion between the petals are usually associated with Ebenads. But if a less value is assigned to that character and more to the presence of albumen, then Storaxworts will fall into a different Alliance, in which they will however present a distinct tendency towards Ebenaceous structure. For this reason they are

here placed among the Rhamnals." The character of the Rhamnal Alliance, as regards the seed and albumen, is "definite seeds and an amygdaloid embryo, with little or no albumen," which, compared with the ordinal characters of both *Sapotaceæ* and *Styracaceæ*, exhibits considerable discrepancy, more indeed than between them and Gentianales, the Alliance at the head of which he places *Ebenaceæ*, and characterizes as having "the cotyledons much smaller than the radicle, lying in a large quantity of albumen." In both *Styracaceæ* and *Sapotaceæ*, with a few exceptions, there is a notable quantity of albumen, the embyro, except in *Bassia* and perhaps one or two others, not being amygdaloidal, but axile in the midst of copious fleshy albumen.

It is with diffidence I venture to differ from such high authorities, but still I cannot help thinking that the views of all are erroneous; misled, perhaps, by Jussieu's location of *Symplocos* in the first instance. I view the affinities of this order as remote, not merely from *Ebenaceæ*, but from the whole sub-class in which it is now stationed. In short, I consider that its true affinities must be sought for among *Calycifloræ* not *Corollifloræ*, and in the neighbourhood of *Caprifoliaceæ.* According to my ideas, *Styracaceæ* fluctuate between *Myrtaceæ*, *Barringtoniaceæ*, *Caprifoliaceæ*, and *Philadelphaceæ*, but most nearly approaches *Caprifoliaceæ* by their adherent ovary, monopetalous corolla, few, pendulous ovules, and long, slender embryo, surrounded by much fleshy albumen. In offering this opinion I do not overlook the fact of Bentham's considering the ovary as properly speaking free, being, according to his view, generally more or less so at the time of flowering, though afterwards adherent. He says, "In *Symplocos*, and in all the genera associated with it, the tube of the calyx is generally more or less free from the ovary at the time of flowering, but with the developement of the fruit it adheres to it more and more, till, at maturity, the tube of the calyx becomes entirely confounded with the fleshy pericarp, and the segments alone remain free, covering the fruit at the top." My acquaintance with the order is confined to the Indian species. Mr. Bentham, when he wrote the above sentence, had been engaged principally with the examination of American ones, and there may be a difference, but so far as Indian species are concerned, I have no hesitation in saying, the ovary is as distinctly adherent in the flower-bud, as it is in the fruit or in any of the above named Calycifiorous orders, and hence, that his observations, if really correct, which I doubt, do not militate against my conclusions which are derived from the examination of other and, it would appear, totally distinct genera, though considered the same.

On turning to *Caprifoliaceæ* I find the essential characters of that order are: adherent ovary; united petals (corolla monopetalous); fruit crowned with the lobes of the calyx; embryo straight, in the centre of a fleshy albumen, with the radicle pointing to the hilum: all of which equally belong to *Styracaceæ.* There are others appertaining to both orders keeping them distinct, but the coexistence of so many, of the highest importance, show how nearly they are related and how perfectly distinct from all the orders among which the latter are now grouped. When constructing the preceding conspectus, I had only cursorally examined the affinities of this order and had not arrived at my present conclusions until after it had been sent to the press.

Geographical Distribution. The species of this order are confined to the tropical and sub-tropical regions of America and Asia; only one is recorded from Africa and none from New Holland. In America they are much more numerous than in Asia. Those belonging to the Indian peninsula are alpine or sub-alpine plants, I do not recollect ever having met with any on the plains, while on both the Neilgherries and Pulney mountains, they are comparatively numerous, nine or ten species being indigenous to the former. A few extend as far north as the Himalayas, at the foot and at moderate elevations of which they are found. One is common at Mussuree.

Properties and Uses. These are not important. Benzoin and Storax are both derived from species of this family, and both form considerable articles of commerce and are to some extent used in medicine, especially in combination with expectorants, the operation of which they are believed to promote. Benzoin enters into the composition of Paragoric elixir and court-plaster. The leaves of some are used in dying, and the Bark of *S. spicata* forms a mordant for red dyes, for which purpose it is imported to some extent into Madras, though common enough in sub-alpine regions among ourselves.

Govindoo del. Dumphy Lith.

SYMPLOCOS SPICATA [ROXB.]

Remarks on Genera and Species. De Candolle divides the order into three tribes, *Symploceæ*, *Styraceæ*, and *Pamphiliaceæ*. Species appertaining to the 2 first are found in India, those of the last are all American. The first tribe contains only one genus, *Symplocos*, but it is a large one, embracing nearly 70 species, and appears too complex in its composition. De Candolle groups the species under 5 sections some of which seem amply distinct to admit of their being viewed as separate genera, as will be seen from the examples given in the supplementary plate devoted to analyses of this and the following order. Linnæus gave two genera, *Symplocos* and *Hopea*, to my mind very distinct: unfortunately the latter was reduced and united with the first and the name subsequently given to a totally distinct Indian genus. This is to be regretted, for, if the Linnæan *Hopea* is again revived, it will cause no end of synonyms between the two genera, a contingency only to be avoided by departing from the rule of priority and adopting one of the other names now reduced. The genus *Hopea* of Linnæus is distinguished from *Symplocos*, by the deeply divided, almost polypetalous corolla, and the stamens free almost to the base; while in *Symplocos* the petals are united at the base into a distinct tube and so, in like manner, are the three or four rows of filaments. (See figs. A. plate 151 b.) It will be remarked that the figures representing vertical sections of the ovary of all the three species, which I have again verified, show that it is completely adherent to the tube of the calyx, and that the apparently free portion is a mere fleshy thickening of the base of the style. In addition to the 8 species figured in the Icones, my herbarium contains several still unpublished ones, but which I cannot venture to characterize without reference to authentic specimens or figures in both of which my collection is deficient.

EXPLANATION OF PLATE 150.

Symplocos spicata.

1, 2. Expanded flower, front and side views.
3. Stamens.
4. Calyx and ovary.
5. The same cut vertically.
6. —— cut transversely.
7. A raceme of fruit, natural size.
8. A detached berry.
9. —— cut transversely, but seed imperfect.
10. Fruit of *S. obovata*, natural size.
11. —— cut transversely.
12. —— cut lengthwise.
13. Detached seed.
14. Same dissected, showing the straight embryo in the midst of copious albumen.

EXPLANATION OF PLATE 151, b. partly.

A. *Symplocos obtusa.*

1. Expanded flower, slightly enlarged.
2. Calyx partially removed to show the enlarged base of the style and 3 stigmas.
3. Ovary cut vertically, adherent to the tube of the calyx.
4. Fruit cut transversely.
5. —— cut vertically, seed and embryo in situ.
6. Embryo detached.
7. *Symplocos pendula.* Expanded flower.
8. Corolla opened, stamens several series, monadelphous, at the base inserted on the tube.
9. Detached stamens, filaments contracted at the point.
10. Calyx opened to show the fleshy base of the style.
11. Ovary cut vertically, adherent to the tube of the calyx; cells 2-ovuled, the upper apparently aborted.
12. Ovary cut transversely, 2-celled with 2 ovules in each.

CII.—OLEACEÆ.

We are now about to enter on the examination of a series of orders characterized by having dicarpillary ovaries, and to that extent, at least, differing from all the preceding corolliflorous ones. On this character I am disposed to place much reliance in tracing their affinities, and therefore direct attention to it in this place. Assuming that I am correct in proposing the removal of *Styracaceæ* from this sub-class, then *Ilicineæ* would form the transition from the polycarpillary to the dicarpillary orders, as having assigned to it a dicarpillary genus, thus confirming the relationship, observed by many Botanists, existing between it and *Oleaceæ*, by showing that, exclusive of other characters, the two orders may be said to touch at that point.

The few genera of this order known to Jussieu, were united by him to the Jasmines, forming the bulk of his order *Jasmineæ*, with which they agree in their monopetalous, diandrous flowers.

And, until lately, many Botanists seemed disposed to adopt this distribution; viewing the two orders rather as sections of one, than two distinct families, though, so long ago as 1806, they had been distinguished. In 1810 Mr. Brown declared them abundantly distinguished by the position of the ovules and structure of the seed, added to the divisions and æstivation of the corolla. While fully coinciding with that most learned Botanist, as to the propriety of their separation, I do not think the reasons assigned quite satisfactory. As regards the position of the ovules and structure of the seed on which he founds it, they are interblended, unless we are prepared to advance a step further, and constitute the section *Chionantheæ* a separate order. This might be done without doing much violence to nature, though I consider it scarcely required; and yet, unless we do so, the ovary, ovules, and seed furnish only partially distinguishing marks between the two families. Brown's character of the ovary and seed of *Oleaceæ* is, "ovarium simplex, biloculare, loculis dispermis, ovulis pendulis collateralibus. Semina albumine dense carnoso, copioso;" of *Jasmineæ*, "ovarium loculis 1-spermis; ovulis erectis. Semen albumine nullo vel parcissimo." I am enabled to set against these, the fact of the ovules of the section, *Chionantheæ*, of *Oleaceæ*, being ascending or even erect, and the seed exalbuminous, and that, of many species of the section "*Trifoliatæ*" of *Jasminum*, having dispermous cells, and the ovules descending, or at all events amphitropous, that is, attached by the middle. I certainly have not yet met albumen except very sparingly in any *Jasminum*, but examples of the others will be adduced, showing that, as regards the ovary, ovules, and seed, the two orders pass into each other and are intimately blended. We must look therefore to other parts of their organization for distinctive marks.

Character of the Order. Flowers hermaphrodite or dioicous. Calyx monophyllous, persistent, 4-cleft or 4-toothed. Corolla monopetalous, hypogynous, 4-cleft or sometimes 4-petaled, with the petals united by pairs by the filaments, sometimes wanting, by abortion, in the female flowers, sub-valvate in æstivation. Stamens 2, attached to the base, alternate with the lobes or petals; anthers 2-celled, dehiscing longitudinally. Ovary simple, free, without a hypogynous disk, 2-celled, with 2 collateral, pendulous or amphitropous ovules in each; style 1 or none; stigma bifid or undivided. Fruit drupaceous, or baccate, or capsular, often 1-seeded by abortion. Seed usually pendulous, albumen generally copious, dense, fleshy; sometimes sparing or wanting. Embryo, when albumen is copious, straight, about half the length of the seed, cotyledons foliaceous; when wanting cotyledons amygdaloid.—Trees or shrubs with opposite, simple or unequally pinnate leaves. Racemes or panicles axillary, or terminal, one bracteate. Flowers often fragrant, white or lilac coloured.

De Candolle remarks that the species of this order often greatly differ both by habit and character, and that their affinities are best brought to light by grafting. "Thus the Lilac will graft on the Ash, the Chionanthus on Fontanesia, and I have even succeeded in making the Persian Lilac live 10 years on the Phillyria latifolia. The Olive will take on the Phillyria and even on the Ash, but we cannot graft Jasmine on any of the Olive tribe, a circumstance which confirms the propriety of separting these two orders."

Affinities. As regards the more remote relationships of this order, Botanists seem pretty well agreed, nearly all referring to *Ebenaceæ*, *Sapotaceæ*, and *Ilicineæ*, as being more or less remotely related; the nearer ones, with the exception perhaps of *Jasmineæ*, are not so obvious. In De Candolle's Prodromus it stands at the head of the series of orders distinguished by their dicarpillary ovaries, as forming the transition order, in the lineal arrangement, between the two groups of corolliflorous orders; those, namely, having more than two carpels, and those, with rare exceptions, limited to two. Bearing this structure in mind, as well as its extreme constancy in orders where it does occur, it provides a nearly invariable line of separation between the Olives and Ebonies, Hollies, &c., otherwise very nearly allied. I say, nearly invariable, for one genus, referable to *Ilicineæ*, has a 2-celled ovary. The line of distinction on the other side is not so well marked, I mean that between the Olives and other dicarpillary orders. The order is itself highly complex, being composed of a number of groups each of which might almost be elevated to the rank of an order.

In *Fraxineæ* (Ash tribe), for example, we have polygamous, apetalous, and also polypetalous flowers, with samaroid fruit and albuminous seed. In *Syringeæ* (Lilacs), we have monopetalous, tubular flowers, capsular fruit, and albuminous seed. In *Oleineæ* (true Olives), we have both tubular and deeply-parted flowers, baccate or drupaceous fruit, and abundantly albuminous seed. And lastly, we have in *Chionantheæ* the flowers and habit of *Oleineæ* combined with ascending or amphitropal, not pendulous, ovules and exalbuminous seed. These might all perhaps be raised to the rank of orders, especially the last, on nearly the same ostensible grounds that led to the elevation of *Jasmineæ*, viz. exalbuminous seed and ascending ovules, but still it seems to me improper to raise them higher than sections, since all have tetramerous flowers and possess the property of intercommunication by grafting, which the Jasmines do not. But while thus complex in itself we find no other that can be confounded with it. Even the Jasmines, which some Botanists seem disposed to unite, and nearly all place next each other, is by others considered but remotely allied, and, if such indeed be the case, we may then look upon both as isolated orders having affinities but no positively near relationships. Lindley observes, "To me I confess that the unsymmetrical flowers of Jasmines offer a great difficulty in the way of placing them in even the same Alliance as Olives, the more especially because that peculiarity is connected with a decidedly nucamentaceous fruit. The two stamens usually present in Oliveworts may be taken to show that the flowers of the order are really $\sqrt[2]{}$ which is confirmed by *Tesserandra*, which has four stamens; the 2 stamens of Jasmineworts are probably connected with a quinary type. The true affinity seems to be with Night-shades, as is indicated by the dicarpillary fruit, regular symmetrical monopetalous corolla, axile placenta and undivided fruit of both orders." On these grounds he places the *Oleaceæ* in his Solanal alliance, next *Solanaceæ;* and *Jasmineæ* in his Echial, next *Boragineæ* and *Labiatæ*, observing that "their unsymmetrical flowers and deeply lobed fruit suggest" that affinity, and seem to point distinctly to those monopetalous orders in which the number of stamens is different from that of the divisions of the corolla, such as Labiates and Verbenas. Different persons draw different conclusions from the same premises and, in common, I believe, with most other Botanists, I confess I cannot see much relationship between *Oleaceæ* and *Solanaceæ*, but think that I can trace a good deal of affinity between them and *Apocynaceæ* and *Loganiaceæ*, and so much between them and *Jasmineæ*, that I cannot tell where the one ends and the other begins, though in their extreme forms so abundantly distinct. Between *Notelæa* and *Jasminum officinale*, the distance is extreme—the former having simple leaves, sub-polypetalous flowers, ovaries with 2 pendulous ovules in each cell, a single sub-drupaceous fruit and copiously albuminous seed; in every one of which particulars the reverse is the case in the other; which is still further removed by the form and number of its calyx lobes, and the æstivation of the lobes of the corolla. But if we compare *Notelæa* with *Jasminum auriculatum* we find the distance considerably diminished by the approximating forms of the calyx, and the ovaries in both having 2 ovules in each cell; the seed are still different, the one being albuminous the other exalbuminous. Passing from *Oleaceæ* to *Chionantheæ*, we find the distance still further reduced, for now the seed of both families are exalbuminous, the ovules of *Chionantheæ* lose their distinctly pendulous character, while those of some Jasmines lose their distinctly ascending one, and become amphitropous. The habit still, however, marks their difference, Jasmines being generally twining and Olives erect, the Jasmines besides have generally a well-developed style, while that of Olives is much reduced or obsolete.—Advancing one step further, we come to *Chondrospermum* which unites the two families. In this genus, the corolla is either 4- or 5-cleft with valvate æstivation, and the style is reduced as in Olives, but the cells of the ovary has only one ascending ovule, and the habit is twining as in Jasmines. The seed is unknown. Here then we have the flower of *Oleineæ* with the ovary and habit of *Jasmineæ:* to which of the two does it belong? And lastly, in *J. rigidum* we have a 4-lobed calyx. The transition between the two orders being thus progressive, I cannot quite coincide with Brown in saying of *Jasmineæ*, "Ordo ab Oleinis abunde diversus situ ovulorum structura seminis nee non divisione et æstivatione corollæ." And still less can I agree with Lindley in viewing Olives as more nearly akin to night-shades than to Jasmines or Jasmines to Echiums than to Olives. The want of symmetry observable in the flowers of Jasmines is not, it appears to me, akin to that of Labiates, but to that of Potaleads, and the rest of the structure more in conformity. On these grounds I view Olives

and Jasmines as being so nearly akin as to be undistinguishable in their extreme forms, and through the medium of the ribbed leaves of the transition species, *Chondrospermum smilacifolium*, brought into almost immediate contact with *Potalieæ.*

Geographical Distribution. This family, though of limited extent as regards the number of species, about 140, has a wide geographical range. Northern Europe, with the exception of Lapland, has its Ash and Privit, and the Lilac has been introduced. Of the southern provinces the Olive proper, as is well known, is a native. Thence they extend Eastwards towards India and China, and Westwards to North America. The genus *Olea* is frequent in India, one half its species, as restricted by De Candolle, being natives. A few are found at the Cape and in New Holland, and three or four in the Mauritius and Madagascar. They are however so sparingly found in Africa, that Endlicher declares them excluded from that quarter of the globe: "Ex Africa exules." In the Indian peninsula they are generally natives of alpine or subalpine regions, enjoying a temperate climate, but are not confined to them, for I have repeatedly met with species in the jungle-covered plains. They are scattered over India from the Himalayas to Ceylon, and Eastward to the Tenasserim provinces, and thence again to China.

Properties and Uses. The Olive oil, so well known, and used for so many purposes, is expressed from the fruit of the common Olive, which, however, is the only one that yields it in any quantity. The Olive itself, preserved in salt and vinegar, is in general repute as an esculent, while the bark and leaves, being bitter and astringent, are considered substitutes for Cinchona. None of the numerous Indian species of *Olea* seem to be employed for medicinal purposes, but the timber of several is in repute for its hardness and durability. A species of Ash furnishes the gentle, sweet aperient, Manna, and the bark is said to possess febrifugal properties, and the leaves to be nearly as cathartic as Senna. Of *Syringa vulgaris* it is recorded, that its febrifugal properties are undoubted. "In that part of the province of Berri, called Brenne, which is marshy and insalubrious to the last degree, the peasants employ no other remedy for the intermittent fever which prevails there."—Lind. A most important fact, since the Lilac is so easily cultivated in Europe and Cinchona is so expensive.

Remarks on Genera and Species. In his late revision of the order De Candolle performed an important service in subdividing it into 4 tribes according to the fruit and seed. The Ash distinguished by its samara or winged fruit; the Lilac by having a capsule; the Olives by their drupe or berry, and the Chionanths by having exalbuminous seed, to which I would add ascending or amphitropous ovules. The former of these is important as some species hitherto referred to *Chionanthus* and *Linociera*, are thereby removed to the Olive tribe, from which they had been separated on account of the elongated lobes of the corolla. Brown remarks under *Chionanthus*, "ab *Olea* differt solummodo figura laciniarum corollæ," from whence it may be inferred that his *C. axillaris* is very nearly akin to my *Olea linocieroides* and *Linociera malabarica*, is also, I now find, a long-petaled *Olea*. It may now be asked whether these should be referred to *Olea* or made to constitute the type of a new genus? The first half of the question I am hardly competent to answer, being so uncertain as to what really does constitute a genuine species of that genus. De Candolle distinguishes his new genus *Visiania* from *Olea* by its fruit, which are thus defined:

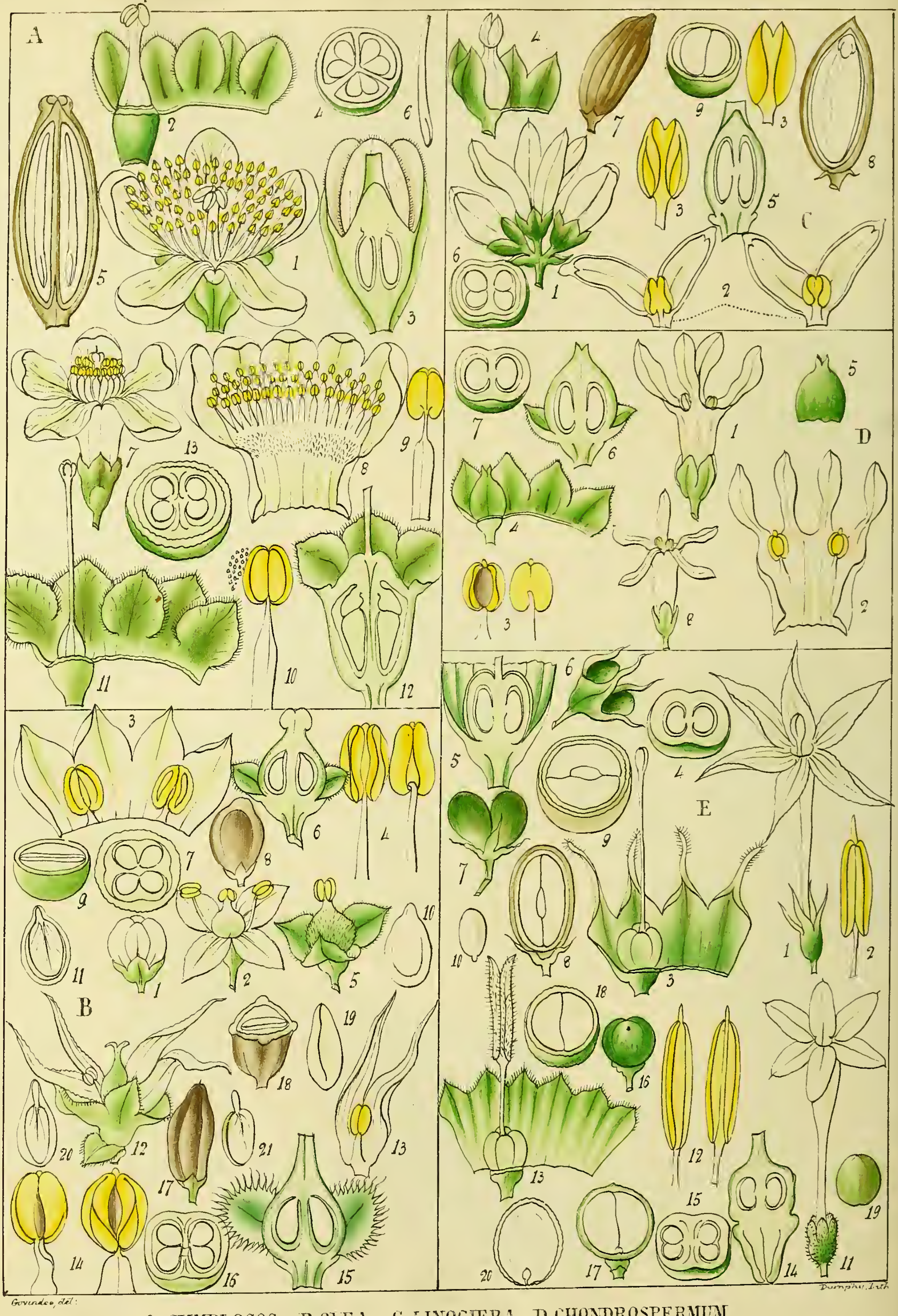
Olea. "Drupa baccata, carne oleosa, putamine osseo, abortu 2 et sepius 1-spermo, semina inversa, albumen carnosum.

Visiania. Fructus obovati, out oblongi, carne parcissima, putamine chartaceo fragili. Albumen carnosum."

According to these characters we have not, so far as I am aware, a single genuine Olive in India, the fruit of all that I have seen being sparingly fleshy with fragile putamen, not hard bony stones like the true olive; nor am I aware of any species of the genus except *O. Europæa* being strictly referable to the genus. A new revision of the order seems, therefore, called for, in the course of which, it seems not improbable that some of the already long

Govindoo, del. Dunphy, lith.

OLEA DIOICA (ROXB.)



Govindoo, del: Dumphy, lith.

A. SYMPLOCOS. B. OLEA. C. LINOCIERA. D. CHONDROSPERMUM.
E. JASMINUM.

list of genera, might be beneficially dispensed with. In the mean time it is quite impossible, by the characters given, to distinguish *Visiania* from the Indian Olives; I, therefore, in publishing a figure of one of the species, referred it to *Olea*, the terminal, panicled inflorescence forming the only distinguishing mark, and to this so high a generic value is not yet accorded, however useful as a specific or even sectional character.

The species employed to illustrate the order is *O. dioica*, as exhibiting petaled and apetalous flowers, but my specimens being defective in ripe fruit, I have in a supplementary plate given analyses of other two species, one with long, the other with short petals, also of a species of *Linociera*, to show the difference in the position of the ovules and structure of the seed. The position of the ovules merits much attention in this family, as by their direction we are enabled to determine the place of an unknown species even without fruit. Roxburgh seems to be the only author who has noticed the amphitropal position of the ovules in the description of his *Chionanthus dichotoma*, and was the first to assign want of albumen as part of the generic character. Endlicher has introduced it into his character, but states that the ovules are suspended from the apex of the septum, which is not the case in any of those I have examined. In *Chondrospermum* the ovules are attached a little below the middle, and are ascending, which led Wallich, when he first described that plant, to suggest that it might more properly belong to *Jasmineæ*. De Candolle has acted on that suggestion and placed the genus at the head of that order, as forming the connecting link between the two, and it certainly participates in some of its characters of both, but of the two seems more nearly to approach *Oleaceæ* in the valvate æstivation of its usually 4-lobed corolla and sessile stigmas. But, view it as we may, it is a very anomalous genus and might with nearly equal propriety be referred, so far as yet known, to either. The fruit, unfortunately, is still unknown, and until it is found its true place cannot be determined.

EXPLANATION OF PLATE 151.

Olea dioica.
1. Flowering branch, male—2. Female.
3. Male flower.
4. Corolla split open.
5. Anthers, back and front views.
6. Calyx and abortive ovary.
7. Female flower.
8. Ovary cut vertically.
9. —— cut transversely.

EXPLANATION OF PLATE 151-b. partly.

B. 1. *Olea glandulifera*, flower-bud.
2. Expanded flower.
3. Detached corolla, split open.
4. Stamens, back and front.
5. Calyx and ovary, calyx, in this instance, 3-lobed, not 4, as usual. See fig. 1.
6. Ovary cut vertically, ovules pendulous.
7. —— cut transversely.
8. A fruit not quite full grown.
9. Cut transversely, showing the embryo in the midst of fleshy albumen.
10. A detached seed.
11. Cut longitudinally to show the embryo in situ.
12. *Olea linosieroides* (R.W.), expanded flower.
13. Two of the petals, united by a filament.
14. Anthers, back and front views.
15. Ovary cut vertically, calyx lobes ciliate.
16. —— cut transversely.
17. A fruit, dried, and somewhat shrivelled.
18. Cut transversely, showing a solitary albuminous seed.
19. A detached seed.
20. A detached seed cut to show the embryo in situ.
21. —— detached embryo.

C. 1. *Linociera intermedia* (R.W.), clusters of flowers.
2. Petals detached, united by pairs by the stamens.
3. Anthers, back and front views.
4. Ovary and calyx, stigma 2-lobed.
5. Ovary cut vertically, ovules amphitropal.
6. —— cut transversely.
7. A mature fruit, real size.
8. —— half the putamen removed, to show the Amygdaloid seed in situ.
9. —— cut transversely exalbuminous.

D. *Chondrospermum smilacifolium*, Wall.
1. Detached flower, corolla 4-lobed.
2. Corolla split open.
3. Anthers, back and front.
4. Calyx and ovary.
5. Detached ovary.
6. —— cut vertically, ovules ascending.
7. —— cut transversely, 1 ovule in each cell.

CIII.—AZIMACEÆ.

This small order, consisting of a single genus, was first defined as such by the late Mr. George Gardner and myself in the Calcutta Journal of Natural History for April 1845. At that time we considered it amply distinct from *Oleaceæ*. A more intimate acquaintance with that order, especially the section *Chionantheæ*, leads me to doubt whether indeed it ought to be retained as a distinct order, a doubt which is strengthened by the discovery of a tetrandrous Oleacea in Miers' new genus *Tesserandra*. With that genus I am not acquainted, not even with the character, but as Lindley adopts it in his Vegetable Kingdom, I have no doubt of its being correctly referred to that order.

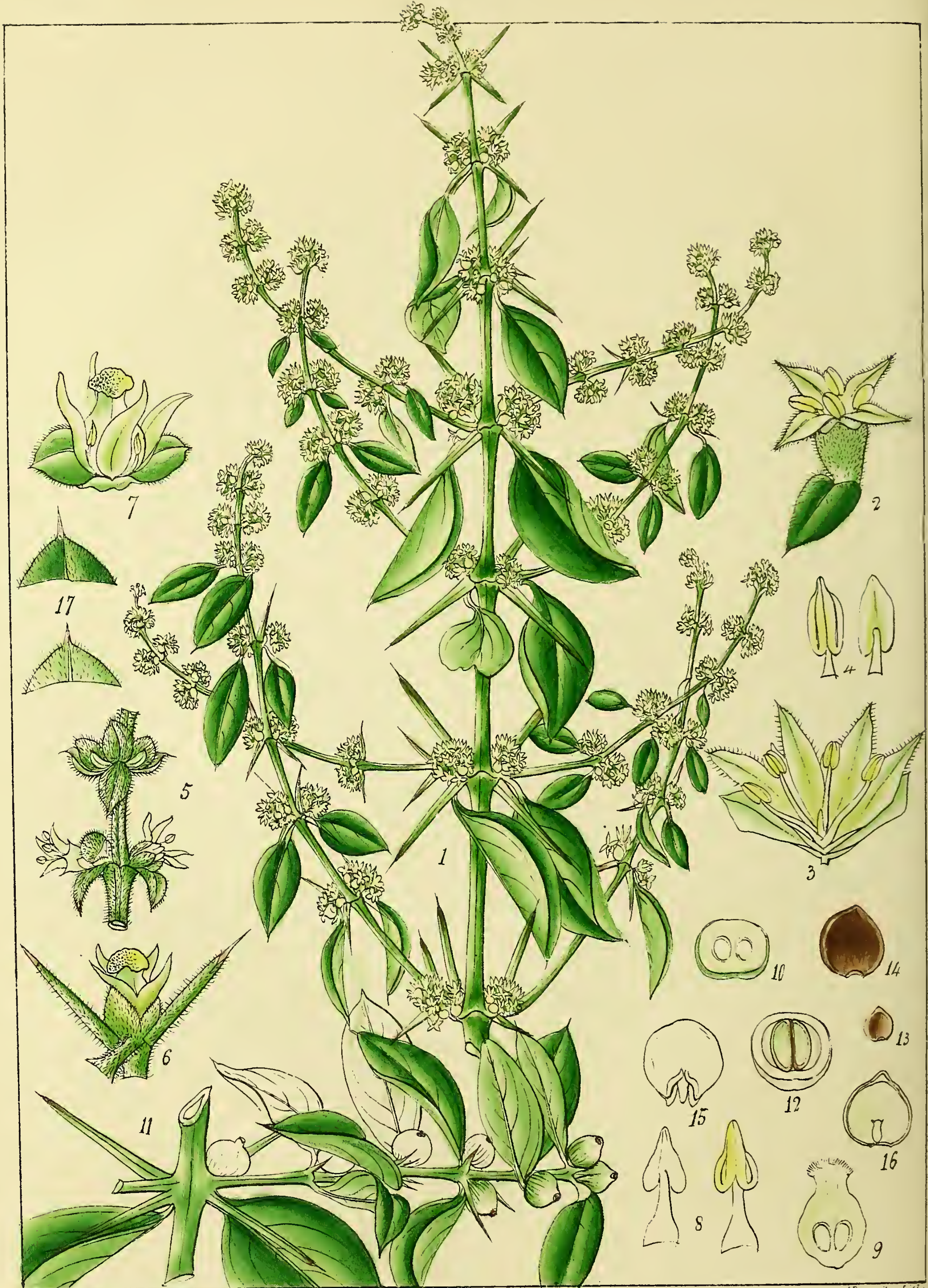
Character of the Order. Flowers dioicous. Male. Calyx urceolate, 4-cleft. Petals 4, hypogynous, equal, æstivation valvate. Stamens 4, hypogynous; anthers 2-celled, introrse, dehiscing longitudinally, connective shortly produced, apiculate. Ovary abortive, conical. Female. Calyx irregularly 2–4-cleft. Corolla as in the male, stamens rudimentary. Ovary hypogynous, turgid, 2-celled, with a single ovule in each cell. Style none; stigma sessile, peltate, somewhat 2-lobed. Fruit a globose berry, 2-celled or rarely, by abortion, 1-celled: cells one-seeded. Seeds erect, plano-convex; testa coriaceous, rugose; albumen none. Embryo lenticular; cotyledons fleshy, cordato-auriculate at the base; radicle inferior.—A rambling shrub with opposite leaves; from the axils of each of which spring two long, divaricate, pungent prickles. Flowers small, axillary, sessile, solitary or aggregated. Fruit a soft, white, very juicy berry.

Affinities. When establishing this order, Mr. Gardner and I expressed our belief that it was intermediate between *Oleaceæ* and *Jasmineæ*, but sufficiently distinct from both, considering it essentially distinct from *Oleaceæ* by its erect not pendulous ovules, and exalbuminous seed (characters to which I now attach less value than I did then); and as agreeing with *Jasmineæ* in the ovary and baccate fruit, but differing in the floral envelopes. I now view it as very nearly akin to *Chionantheæ*, in fact as almost referable to that group, the points of distinction, so far as I can see, scarcely attaining ordinal value. Lindley places it among the *Ilicineæ* without any doubt, a distribution which its erect ovules and exalbuminous seed prevents my adopting. Others have placed it in *Apocyneæ*, and D. C. suggests, that it may belong to *Loganiaceæ* which I view as being about equally remote from its real affinities, but both tending to confirm the propriety of its present location; while the existence of a tetrandrous genus (*Tesserandra*) in *Oleaceæ* seems to justify the remark that it is not sufficiently distinct from that order. M. Bojer of the Mauritius also suggests its affinity with *Loganiaceæ*.

Geographical Distribution. India and the Cape of Good Hope are the only countries in which *Azima* has yet been met with. In India it is most abundant and widely distributed over the peninsula, but I am unable to say how far north it extends. Wallich refers to a species from Burmah; and Harvey characterizes the genus from Cape specimens.

Properties and Uses. Little seems kuown under this head. The leaves when bruised have a peculiar, heavy, disagreeable, musky smell, and the juice is by the natives prescribed as an expectorant in cases of Cough, Consumption, and Humoral Asthma, but as it is always conjoined with many other things, it is impossible to say to what extent the benefit derived, if any, is due to its curative action. The powder of the roots is also occasionally similarly employed.

Remarks on Genera and Species. In an order consisting of one genus, and two or three species, there is little room for remarks under this head, I shall therefore content myself with one or two passing remarks on the name we have adopted for the order. Lamack first named and published the plant on which it is founded in 1783 in the Encyclopedia Methodique, a large and costly work, and of course likely to be in few hands. In 1784 L'Heritier repub-



Covindoo, del. Dunphy, Lith.

AZIMA TETRACANTHA (LAM.)

lished it in his "Sterpes Novæ," a less costly work, but, apparently not being aware of Lamack's name, called the genus *Monetia*, which soon became the better known of the two, and seems to have been generally adopted by all subsequent writers except Jussieu and Persoon. Of course in constructing the order, we adopted the name which had priority in its favour, in the hope of at the same time doing justice to the original discoverer, and preventing an unnecessary synonym being added to our list.

EXPLANATION OF PLATE 153.

Azima tetracantha.
1. Flowering branch, natural size.
2. Male flower.
3. Same split open.
4. Anthers back and front views.
5. Flowering shoot, female.
6. Female flowers, and accompanying spines.
7. Female flower dissected.
8. Stamens of female flower.
9, 10. Ovary cut vertically and transversely.
11. Branch with mature fruit.
12. Fruit cut transversely.
13. Mature seed.
14. —— magnified.
15. Testa removed, showing the large cotyledons and inferior radicle.
16. Cotyledons seen from within.
17. Portions of a leaf magnified, showing the pubescence.

CIV.—JASMINEÆ.

This, so far as the name goes, is an old order, being first so designated by Jussieu, but as he constructed it, it was rather complex, including both Jasmineæ and Oleaceæ, and two genera belonging to other orders. Mr. Brown in his Prodromus limited the order to *Jasminum* and *Nyctanthes*, separating the Oleaceous genera to form a distinct family. This arrangement has been pretty generally adopted by subsequent Botanists, but not unanimously. Richard, I believe, still adheres to the old order and in 1831, when Dr. Arnott's article "Botany," in the Encyclopedia Britannica, appeared, he held the same views; but has since adopted Brown's. Until very recently, I had no doubt on the subject, considering them as thoroughly distinct as *Jasmineæ* and *Asclepiadeæ*, and I still think them quite distinct, though I confess I am unable, while *Chondrosperm* remains here, to tell where the one begins and the other ends. Under *Oleaceæ* I have shown that characters taken from the position and number of the ovules, and from the structure of the seed, are not sufficiently constant to be relied on, hence it appears, that we must look to habit and æstivation of the corolla, as furnishing in the main the most constant characters, *Oleaceæ* being generally arborious or erect rigid shrubs with valvate æstivation of the corolla; while Jasmines, excluding *Nyctanthes* and *Schrebera*, are voluble shrubs with twisted æstivation. To these may be added, if I may use the expression, that tetramerous diandrous flowers are characteristic of *Oleaceæ*, whereas pentamerous diandrous ones seem to appertain to *Jasmineæ*. These are all important distinctions and seem sufficient, not merely to separate this diandrous group of plants into two orders, but even into different groups or alliances as Lindley has done.

Character of the Order. Flowers hermaphrodite, unsymmetrical. Calyx persistent, 4–8-toothed or lobed. Corolla hypogynous, 1-petaled, 5–8-lobed, salver shaped; lobes imbricated in æstivation, the 2 exterior ones twisted or valvate. Stamens two, attached to the tube, incluse. Anthers 2-celled, introrse, bursting longitudinally. Ovary destitute of a hypogynous disk, 2-celled, 2-lobed at the apex; ovules ascending or amphitropous 1–2, rarely more, in each cell; style simple; stigma 2-lobed. Fruit bibaccate or capsular; capsules 2-celled, bipartible, cells indehiscent. Seed exalbuminous or with sparing albumen, testa often tumid; embryo straight; radicle inferior. Erect or scandent shrubs: leaves opposite, rarely alternate or often unequally pinnate, leaflets 3–5–7, or sometimes, by abortion of the lateral leaflets, reduced to one, but then on a jointed petiol, indicating its compound nature. Flowers corymbose or panicled; pedicels opposite, 1-bracteate. Corolla white or yellow, often fragrant.

Affinities. These, as already mentioned under *Oleaceæ*, I consider obscure. When that article was written, and even in type, I was not aware that De Candolle had added *Schrebera* (Roxb.), to the order. This addition, assuming that that genus is a true congener, appears to add to the difficulty by rendering them more complex. At the present time most Botanists coincide in considering *Jasmineæ* and *Oleaceæ*, very nearly allied orders, but distinct especially as shown by the pentamerous tendency of the flowers of the former, as compared with the tetramerous tendency of those of the latter. I have shown above that the transition from the one to the other, is gradual and that they actually meet in *Chondrospermum*, which appertains so far as yet known, about equally to both orders, being doubtfully placed in the one by Wallich and in the other by De Candolle. To Lindley, however, it does not appear that Jasmines have any real affinity with Olives, on the contrary he regards their unsymmetrical flowers, and deeply lobed fruit, as suggesting a very different affinity and seem to point distinctly to those monopetalous orders, in which the number of stamens is different from that of the divisions of the corolla, such as Labiates and Verbenas, but particularly the latter which sometimes resembles Jasmines, in their fruit, as happens in *Clerodendron*. As regards *Jasminum* I am disposed to coincide with those Botanists who view its affinities as appertaining to the *contorteæ* group of orders, *Apocynaceæ*, *Loganiaceæ*, *&c.*; but with respect to *Nyctanthes*, think that Lindley's views are nearer the truth. As regards *Schrebera* on the other hand, its affinities fluctuate between *Bignoniaceæ* and *Acanthaceæ*, having the compound foliage, panicled inflorescence and winged seeds of the former, with the hard capsule, and somewhat elastic dehiscence (each valve bearing half the septum), of the latter, but differing from both in having the pendulous ovules and seed of some *Pedaliaceæ*.

Assuming that all these genera are true congeners, it follows that the relationships of this small order are most extensive and complex, *Jasminum* associating with one set of orders, *Nyctanthes* with another, and *Schrebera* with a third. In a word, I view *Jasminum* as being properly placed in Endlicher's class *Contortæ*, along with *Apocynaceæ*, *Asclepiadeæ* and *Loganiaceæ*: *Nyctanthes* in Lindley's Echial* Alliance, with *Boragineæ* and *Verbenaceæ*, while *Schrebera* associates in some striking points with *Pedaliaceæ*, *Bignoniaceæ* and *Acanthaceæ*, of the Bignonal alliance.

Geographical Distribution. India is certainly the head quarters of this order, in nearly all parts of which they are found and in many places greatly abound. They extend from the sea-coast to the tops of the highest mountains. From India several extend eastwards as far as China, and the South Islands: some are natives of Africa and the adjoining Islands, and several are natives of New Holland. Two species of *Jasminum* and four of *Bolivaria*, are natives of South America, and two Jasmines claim the south of Europe as their native country, where they are justly prized for the formation of arbours.

Properties and Uses. These are not important. The flowers of *J. officinale* and *grandiflorum* furnish the genuine essential oil of Jasmine, but an inferior kind is also, I believe, in this country, extracted from *J. Sambuc*, the flowers of which are also much used in the formation of native ornaments such as necklaces, and for dressing the hair on occasions of ceremony among the natives. The roots of one species is used medicinally as a remedy for ringworm and herpes. And the orange-coloured tubes of *Nyctanthes arbor tristis* are much used by the dyer to obtain a yellow dye.

Remarks on Genera and Species. Three genera only of this order are known in India, *Jasminum* and *Nyctanthes*, and recently *Schrebera* has been added by De Candolle. The flowers are much alike but the fruit very different, the first having a succulent berry, the second a flattened capsule and the third a hard oblong pear-shaped one, so that there

* In the remarks on my 3d group, page 129, I inadvertently named Lindley's *Echial Alliance* as corresponding with my 4th group, I therefore beg the favour of the reader deleting the words "as suggested by Lindley who places it in his Echial Alliance," and inserting the word "however" after carpels, in the following line.

JASMINUM GARDNERIANUM (R.W.)

is no difficulty in distinguishing them when fruit are available, and when flowers only are found, their very distinct habits furnish good distinctive marks, the true Jasmines being nearly all twiners with smooth leaves; Nyctanthes erect shrubs with very rigid rough ones; and Schrebera a tree with a smooth pinnate foliage. The discrimination of the species of *Jasminum* is however often difficult. While naming those belonging to my Herbarium, I found it a convenient plan to group those with very short blunt calyx lobes, most of which I found had two ovules in each cell. The common *Jasminum auriculatum* may be taken as the type of this group, but some others are also distinguished by the ovaries having two ovules in each cell. By this character therefore the genus might be conveniently divided into two sections. De Candolle groups them according to their foliage, *Unifoliolata*, *Trifoliolata*, *Pinnatifolia*, and *Alternifolia.* The first of these divisions is occasionally apt to mislead, owing to the abortion of the lateral leaflets, an example of which is presented by *J. brevilobum*, a trifoliolate species but placed in DC.'s first section. The ovary has four ovules, the lobes of the calyx are very short and blunt, and the lateral leaflets small, as in *J. auriculatum*, whence it may almost be viewed as an alpine variety of that species.

The following extract from my Spicilegium Neilgherrense exhibits, in a few words, the results I obtained while examining the ovaries of a number of species of this genus, and leads to the conclusion that further investigations of the same kind are required towards the elucidation of the rest of the genus.

"The bulk of this (generic) character is copied from De Candolle, but to render it applicable to the genus, as I have found it in India, it was necessary to introduce a few words regarding the ovary and ovules. In the original 'Ovarium bilobum,' is all that is said regarding that important organ, and that little is not in accordance with my experience, the ovary not being two-lobed, when the flower drops, though the fruit, owing to a peculiarity in its mode of growth, afterwards becomes two-lobed. The number and position of the ovules, as here stated, differ from the generally received character. In Endlicher's Genera Plantarum it is said, 'Ovula in loculis solitaria a basi dissepimenti adscendentia anatropa.' This is only partly right as I have found many with 2 ovules in each cell, and one, perhaps accidentally, with three; some with them positively pendulous, from near the apex of the cell, and several with them lateral, but attached above the middle, so as to be in truth descending not ascending ovules, but few indeed, if any, really erect; that therefore I consider of rare occurrence, as compared with the other structure."

The genus *Nyctanthes*, consisting of a single, well-known species, does not require further notice here. *Schrebera*, being comparatively rare, is less known. Roxburgh's description is imperfect in some points and his figure erroneous in one essential particular and deficient in others. He does not, for example, describe the structure of the ovary or seed, represents the latter in the mature open capsule as erect, and does not clearly show the loculicidal dehiscence and contrary partition. According to my specimens, I find the corolla quincuncial in æstivation, the ovary 2-celled with 4 ovules, pendulous from the top of the partition in each. The seed are similarly pendulous with the wing directed towards the base of the capsule. The capsule, as mentioned by Roxburgh, splits from the apex into 2 valves, through the middle of the partition, each valve bearing a half, as in *Acanthaceæ.* The seed is furnished with a knife-shaped wing at the end, remote from the hilum; the endopleura is thick and spongy; the cotyledons large, fleshy, deeply furrowed, enclosed in a thin membranous albumen; the radicle next the hilum, short. In other respects the description and figure, so far as my rather imperfect specimens enable me to judge, are correct.

EXPLANATION OF PLATE 153.

Jasminum Gardnerianum (R. W.), shrubby, climbing and twining, glabrous: leaves ovate, undulated, retuse, pointed; petiol articulated near the base: cymes terminal, panicled; peduncles about the length of the leaves: calyx 5-toothed, teeth short, acute: corolla about 8-lobed; lobes lanceolate, acute, the length of the tube: anthers oblong, connective, produced into a long point: ovules 1 in each cell, amphitropous: berry solitary by abortion, oblong, oval, obtuse at both ends, dark purple. Coimbatore, frequent, climbing over hedges and bushes, flowering the greater part of the year but in greatest perfection in April and May. Flowers white, about the size of those

of J. officinale, fragrant. The leaves on young luxuriant shoots are often alternate. This seems to be intermediate between *J. attenuatum* and *J. gracile*

1. Flowering branch, natural size.
2. Cyme of flowers.
3. Corolla split open, stamens in situ.
4. Anthers, back and front views.
5. Ovary and calyx.
6, 7. Ovary cut vertically and transversely.
8. Cyme of fruit, one half of each aborted.
9. Detached berry.
10. 11. Mature fruit, cut vertically and transversely.
12. Detached seed, testa removed.
13. A seed lobe.

CV.—APOCYNACEÆ.

This order has, in the course of M. Alphonse De Candolle's recent revision, became a large and highly interesting one. It was first defined by Jussieu, but as left by him, included nearly all the then known genera of the present *Apocynaceæ*, *Asclepiadeæ* and *Loganiaceæ*. Brown, on subsequently revising the order, separated *Asclepiadeæ*, as a distinct family, and assigned to *Apocynaceæ* its present limits, with the exception of a few genera, which have since been removed to form the type of the new order *Loganiaceæ*. The trible order, if I may so call it, as left by Jussieu, contained in all only 29 genera. Of *Apocynaceæ*, there are now 100, of *Asclepiadeæ* 133, and of *Loganiacæ* 26—total 259 ; a vast increase in the space of 60 years, and rapid as has been the increase of genera, I believe that of species has not fallen much short of the same proportion. This order has very recently been carefully revised by Professor Alph. De Candolle, and his monograph published in DC.'s Prodromus. Since then he has published in the "Annales des Sciances Natur." for 1844, an excellent memoir on the family, in which he has given an elaborate account of its peculiarities and affinities.

Character of the Order. Calyx free, 5-parted, persistent, lobes usually furnished within with scales or glands. Corolla monopetalous, hypogynous, regular, 5-lobed, the throat often furnished with scales; æstivation contorto-imbricated. Stamens 5, arising from within the tube of the corolla, alternate with its lobes; filaments distinct; anthers adhering firmly to the stigma, 2-celled, opening longitudinally; pollen granular, globose, or 3-lobed, immediately applied to the stigma. Ovary free, usually embraced at the base by a fleshy nectary composed of 5 glands placed opposite the lobes of the calyx, single or double; when single, 2- or rarely 1-celled; when double, united at the apex into a single style; ovules usually numerous, amphitropous or nearly anatropous; style simple; stigma frequently enlarged at the base, expanding into a ring or campanulate membrane, contracted in the middle, and simple or two-cleft pointed or dilated at the apex. Fruit follicular, capsular, baccate or drupaceous. Seed usually pendulous, sometimes ascending, naked, or variously comose, sometimes winged, often albuminous; embryo straight; radicle usually superior, cotyledons flat, rarely convolute.—Trees, shrubs, or under shrubs, rarely herbaceous, with milky juice; stems frequently twining; leaves opposite, or whorled, rarely alternate, simple, entire, rarely stipuled, but often having glands in the place of stipules; flowers usually cymose, sometimes racemose, regular, often large and handsome.

Affinities. These certainly lie with *Gentianceæ* and *Loganiaceæ*, on the one side, and *Asclepiadeæ* on the other. *Asclepiadeæ*, with which they were at first associated by Jussieu, though in some points nearly related, are scarcely, as it appears to me, so nearly allied as either of the others. That they have many points in common is most certain, but on the other hand the flowers in the two families are very different. The twisted æstivation, the absence of stigmatic corpuscules, the different structures of the stigma and anthers, and the granular not waxy pollen, are all weighty distinctions, especially when added to the generally albuminous seed of the one, and exalbuminous ones of the other, forming a combination of characters, not to be gainsayed. Much stress has been laid by both Brown and Alph. De Candolle on the difference of the pollen. The latter even goes so far as to say "that the only precise and universal distinction between the two families is found in the organization of the pollen,"

a position which I feel some hesitation in adopting especially as applied to the section *Periploceæ*, the dilated corpuscules of which are often found covered with minute, globose pollen-grains, sufficiently resembling those of *Apocynaceæ.* Hence I should conclude that, if any one character more than another was to be chosen, on which to found a generally-applicable distinction between these two orders, I would select the stigmatic corpuscules, which, in some form, I have never seen wanting in Asclepiadeæ, in preference to the pollen. But in this case it is not necessary to have recourse to single characters, since each family supplies several. No *Apocinia* presents an approximation to a regular gynostegium and stigmatic corpuscules and neither, I believe, is any Asclepiadeous plant altogether without them. But while I thus, with Lindley, view the two orders as amply distinct, I cannot coincide with him in considering the correspondence between them as one of analogy rather than affinity, and viewing *Asclepiadeæ*, as more nearly allied to *Solanaceæ* than to *Apocynaceæ.* On the contrary, I am inclined to view the four orders associated in my fourth group as all very nearly related, and suspect that *Jasmineæ* might, without much violence, be added to the group, but of this last I speak with great hesitation. I have already adverted, under *Cinchonaceæ*, to the relationship existing between that order and this one. In addition to the distinguishing marks, between these orders, derived from the position of the ovary and the presence of stipules, I may add here the milky juice, so general in *Apocynaceæ*, but not found in the other.

Geographical Distribution. The tropical parts of Asia may be stated as the focus of this order. They abound in Southern India and Ceylon, and in the Eastern Islands; a few extend Southwards to Australia, also to Africa and her Islands. In the tropical parts of America they are more numerous than in either of these Continents, perhaps, in some measure, owing to the flora of the latter being better known. In Europe aud North America a few occur, two of which (*Vinca's*) are natives of England.

Properties and Uses. As in most milky plants, these are of considerable energy and in some cases of great virulence, but in others they are mild, and in a few the fruit is edible. Of the former, *Tanghinia veninifera*, a Madagascar plant, affords a striking example. It is recorded of this plant that the kernel of the fruit, though not larger than an Almond, is sufficient to poison twenty people, while on the other hand the pulpy fruit of our Calacca (*Carissa carandas*) boiled with syrup makes a very passable preserve and tart fruit. A jelly resembling that of red currants is obtained from it. The fruit of other species of Carissa is also edible as is that of *Willughbeia edulis*, Roxb. This brief catalogue nearly exhausts those distinguished for the possession of mild properties in the fruit. The kernels of *Cerbera mangas*, a common Malabar tree, are poisonous, and in small doses act as an emetic; the sap is purgative and in Java the leaves are used as a substitute for Senna. Two allied genera, *Allamanda* and *Thevetia*, possess nearly similar properties, both being acrid and poisonous, but when carefully administered become safe evacuants. The bark of *Thevetia neriifolia*, an American species, but now not uncommon in India, is said to be so powerfully febrifuge that two grains of it is equal to a full dose of Cinchona. The common Oleander, though little suspected, is a highly poisonous plant. The roots of the one so common in India are well known to the natives as such, and Lindley relates an instance, where a number of French soldiers were poisoned by eating meat roasted

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EXPLANATION OF PLATE 151-b. partly.

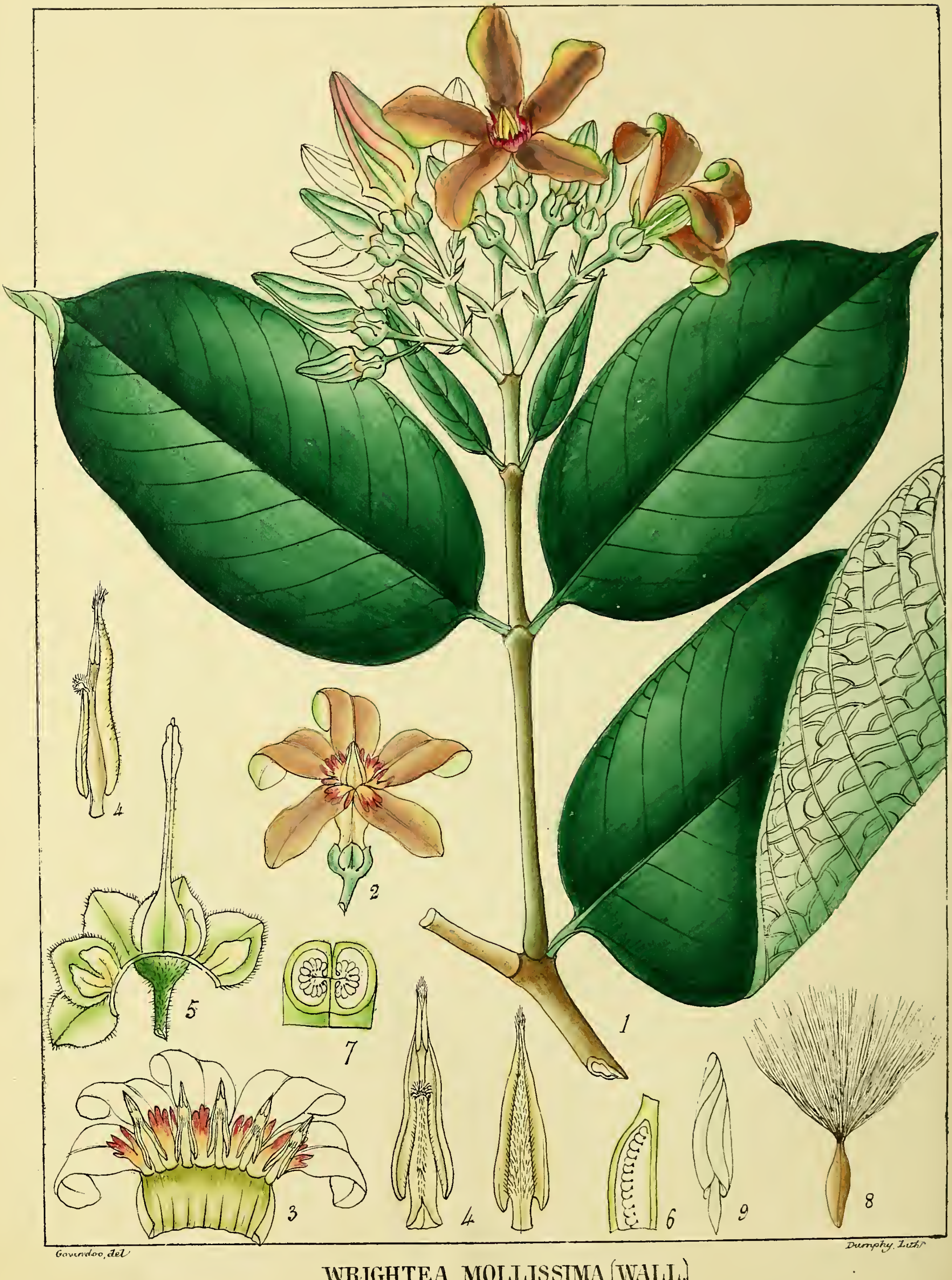
E. *Jasminum rigidum* (Zinker).
1. Detached flower.
2. An anther.
3. Calyx and ovary.
4. 5. Ovary cut transversely and vertically, ovules amphitropal.
6. 7. Fruit about half grown and nearly mature.
8. 9. Cut vertically and transversely.
10. Detached seed, natural size.
11. *Jasminum brevilobum*, detached flower.
12. Anthers, back and front.
13. Calyx and ovary.
14. 15. Cut vertically and transversely.
16. Full-grown fruit.
17. 18. Cut vertically and transversely.
19. Detached seed, natural size.
20. Seed-lobe, radicle at the base.

on sticks of Oleander used as spits. The leaves of, what appears to me, *Wrightia tinctoria* are, I learn, employed in Mangalore as an effectual remedy in cases of toothache. The fresh leaves are well chewed, and being very pungent, speedily act as a powerful sialogogue, which quickly and effectually removes the pain. I have not yet had an opportunity of ascertaining whether the fresh leaves are thus pungent, but I find that the dried ones, sent for inspection, have lost much of that property in drying, and with it I presume their virtues. *Holarrhena antidysenterica*, a very common and handsome flowering shrub on the Malabar coast, has been long held in repute on that coast, on account of the astringent and tonic properties of its bark, which is prescribed both to cure fevers and arrest bowel complaints; the seed also, having been first slightly toasted, are prescribed, in infusion, in slighter forms of bowel complaint. The roots of *Ichnocarpus frutescens*, in common with those of *Hemidesmus indica*, are currently employed in European hospitals under the name of country Sarsaparilla. The wood of *Alstonia scholaris*, a common Indian tree, is as bitter as Gentian, and possessed of somewhat similar properties; and the roots of *Ophioxylon Serpentinum*, so called with reference to its reputed antidotal powers in cases of snake bite, are certainly tonic, and are supposed to act on the uterine system somewhat in the manner of Ergot of rye. While the tendency to the production of poisonous and acrid secretions, is thus the predominating characteristic of the order, we find some remarkable exceptions to the rule. The cow tree of Guiana, a species of *Tabernimontana* yields, when wounded, a copious stream of thick, sweet, wholesome milk; so also the juice of some species of *Cerbera* lose the venomous qualities found in the fruit of others of that genus. The juice of *Urceola elastica*, furnishes a fine Caoutchouc, as does that of several others, but of inferior quality. The leaves of *Wrightia tinctoria* furnish an Indigo of excellent quality in very considerable abundance. As regards the timber of the arborious forms little seems to be known, probably owing to few of them attaining a large size.

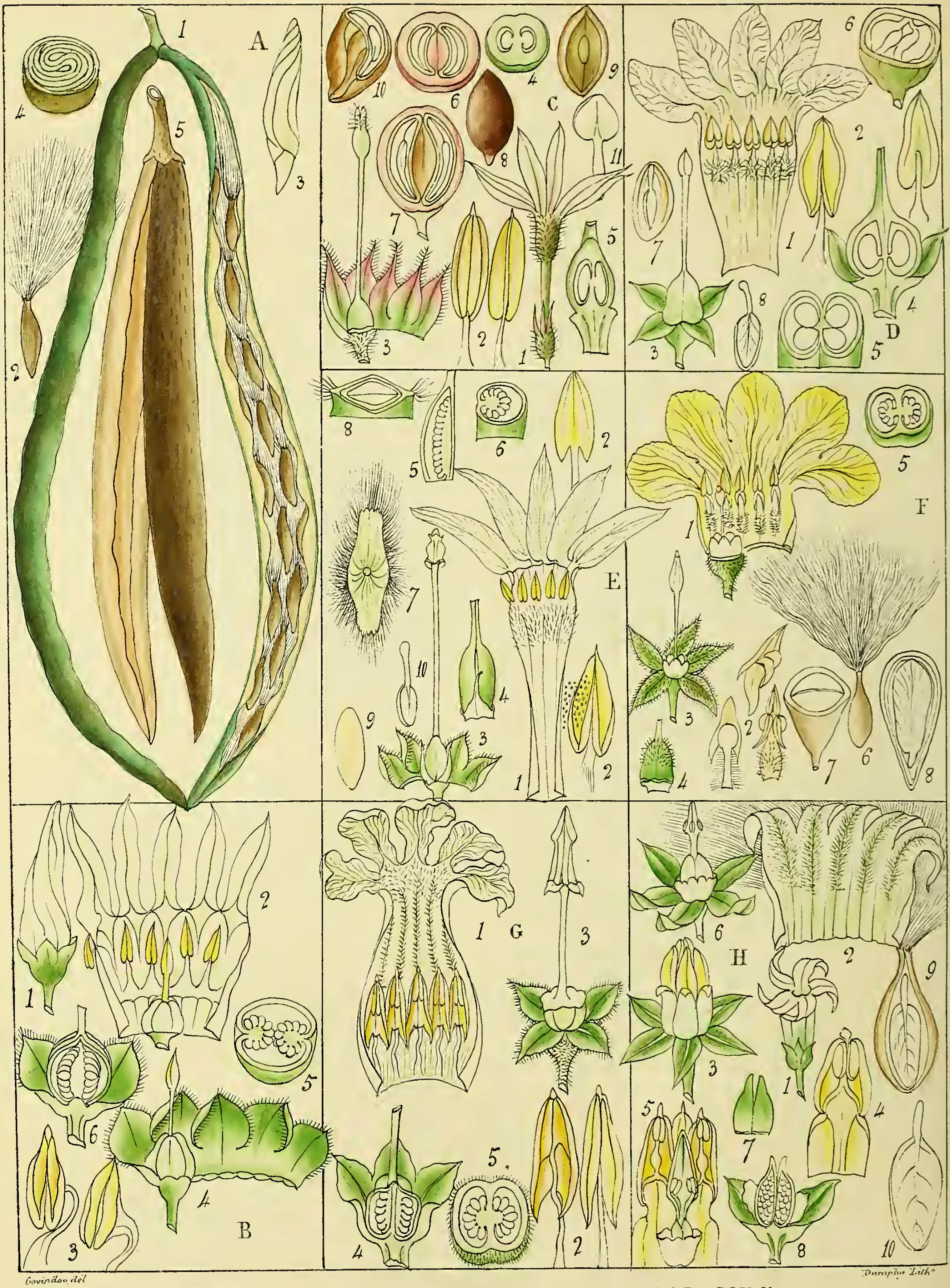
Remarks on Genera and Species. In an order embracing at least 100 genera, arrangement and sub-division into groups are quite indispensable, towards conveying clear conceptions of their differences as well as to facilitate their investigation. The seed and fruit of this order, fortunately, to a great extent, afford facilities for such grouping, which has been most successfully taken advantage of by Alph. De Candolle, in his recent monograph. The former are either naked or variously furnished with a tuft of pappus-like down. These differences of the seed form the primary division, viz. Semina calva and Semina comosa. The naked seeded ones are again divided into those having a 1-celled ovary; those with 2 cells; and those with 2 separate ovaries, but only one style. The second series, with 'coma,' is in part similarly grouped. It is first divided into two; viz. 1st, ovary single, 2-celled, seed comose above: 2d, ovaries two, distinct; which is again sub-divided into (1st,) seed comose below, or next the base of the follicles: (2d,) comose at both ends, and (3d,) comose above—or remote from the base of the follicle. Of each of these groups, an example will be found in the accompanying plate, 154-6. These differences are represented by the author in the following tabular form, copied from the Annales des Sciences Naturelles, for 1844, page 254.

				Tribus.
Apocynaceæ.	Semina calva.	Ovarium unicum uniloculare, - - -		1. Willughbeieæ.
		Ovarium unicum biloculare, - - - -		2. Carisseæ.
		Ovaria duo distincta, - - - - -		3. Plumerieæ.
	Semina comosa.	Ovarium unicum biloculare. Semina superne comosa,		4. Parsonsieæ.
		Ovaria 2 distincta,	Semina inferne comosa, - -	5. Wrightieæ.
			Semina utrinque comosa, - -	6. Alstonieæ.
			Semina superne comosa, - -	7. Echiteæ.

These groups, though not altogether unexceptionable, yet appear to me the nearest approach to perfection, that has yet been, or perhaps that can be made, for the exceptions are few and partial. In the construction of his generic characters, every part of the flower and fruit is made use of; and an organ not previously employed, though known to exist, has been largely taken advantage of in the limitation of his genera, I mean the glands within the calyx. These were noticed by Brown in his memoir on this order, but scarcely employed in his generic characters. De Candolle, having a more extensive field to work upon, and many imperfectly described species to examine, found it desirable to ascertain their value as generic characters, and has laid



WRIGHTEA MOLLISSIMA (WALL.)



Govindoo del. Dumphy Lith.

A. WRIGHTIEÆ B. WILLUGHBEIEÆ. C. CARESSEÆ
D. PLUMERIEÆ. E. ALSTONIEÆ. F. PARSONIEÆ.
G. ECHITEÆ H. ECHITEÆ.

Botanists under great obligation, for the pains he bestowed on their examination. In the course of my examinations I found them useful both as generic and specific characters. Another point of structure, of which the same accomplished and careful observer has made much use, is the nectarial scales or glands embracing the base of the ovary, within the corolla: these also I have found very useful, as often furnishing excellent characters, being, though minute and occasionally somewhat difficult to investigate, very constant in each species. In the course of my recent examination of the Indian species, I found it necessary to add three new genera to the order. One of these (*Ellertonia*, R.W. Icon. 1295) appertains to the *Alstonieæ* section, but is distinguished by having the seed winged in place of comose. Another (*Epigynum*, R.W. Icon. 1308), a Mergui plant, has the ovary adherent! to the tube of the calyx, and will perhaps be found referable to the *Parsonieæ* section; but the fruit is still unknown. The plant is an interesting one, as forming the nearest connecting link between this order and *Cinchonaceæ*. At first, owing to my looking too much to the corolla, and not enough to the ovary, I suggested that it might, perhaps, be allied to *Ecdysanthera*, which can scarcely be the case. Of the third genus (*Cleghornia*, R.W. Icon. 1310,11), I feel less confident of its stability, as it so nearly approaches *Echites* in generic characters, but still, I anticipate it will be retained, as all the known genuine species of that genus are from America, and, so far as I am acquainted with them, appear very different. *Ellertonia* has been long known, but only from Rheede's plate, and in consequence much misunderstood. Willdenow first quoted it as a synonym for *Echites costata*, Forst., an error pointed out by Brown. Roxburgh next quoted it as a synonym for his *Echites caryophyllata*, and as such was retained by Don for his *Aganosma Roxburghii*. De Candolle also retains it, but with the remark ("fide Rox. nam icon mediocr. cum sequentibus pariter convenit aut non") from which it would appear that, since the time of Rheede, it has not again found its way into any herbarium, until I got specimens, several years ago, from the Malabar coast. In addition to these genera, I have published figures of several new species in my Icones, for characters of which I beg to refer to that work.

EXPLANATION OF PLATE 154.

Wrightia Mollissima (Wall.), flowering branch.

1. Detached flower.

2. Corolla removed and split open; anthers and orange coloured crown inserted on the throat.

3. Stamens, different views.

4. Calyx and ovary, the former opened showing the calycine scales.

5. 6. One cell of the ovary, cut vertically and transversely.

7. Mature seed, and 8. the same, the testa removed showing the rolled up foliaceous cotyledons, seed exalbuminous.

EXPLANATION OF PLATE 154-b.

A. 1. *Wrightia tinctoria,* mature follicles somewhat reduced.

2. A seed with its attached coma.

3. The same, testa removed. 4. Seed cut transversely.

5. Follicles of *W. Mollissima* from Wall. Pl. Asiat. rar. reduced in size.

B. Willughbeieæ *Chilocarpus Zeylanicus* (R. W.).

1. Flower before expansion.

2. Corolla split open, stamens and pistil in situ.

3. Anthers, back and front views.

4. Calyx and ovary. 5. Ovary cut transversely, 1-celled. 6. Cut vertically.

C. Carisseæ. *Carissa paucinervia* (Alph. DC.).

1. Corolla slightly magnified.

2. Stamens back and front views.

3. Calyx and pistil. 4. Ovary cut transversely.

6. Cut vertically, ovules amphitropous.

7. Mature fruit cut transversely. 7. Cut vertically. 8. A detached seed, back view.

9. The same seen from within. 10. Cut transversely. 11. Detached embryo.

D. Plumerieæ. *Huntera Roxburghiana* (R. W.).

1. Corolla split open, stamens in situ.

2. Detached stamens.

3. Calyx and pistil. 4. Ovary cut vertically. 5. Cut transversely.

7. A dissected seed, embryo in situ. 8. Detached embryo.

E. Alstonieæ. *Alstonia scholaris* (R. Br.).

1. Corolla split open, stamens in situ. 2. Anthers.

3. Calyx and pistil. 4. Ovary detached. 5. Cut vertically. 6. transversely.

7. A mature seed. 8. Cut transversely. 9. Testa removed. 10. Embryo detached.

F. Parsonieæ. *Vallaris dichotoma* (Wall.).

1. Flower, corolla split open, showing the cup-shaped nectary and stamens in situ. 2. Stamens.

3. Calyx and pistil. 4. Detached ovary. 5. Cut transversely.

6. A seed. 7. Cut transversely, albumen sparing. 8. Cut longitudinally, large embryo in situ.

G. Parsonieæ? *Epigynum Griffithanum* (R. W.).

1. Corolla split open, stamens in situ. 2. Stamens. 3. Calyx, nectary, and pistil. 4. Ovary cut vertically, adherent to the tube of the calyx. 5. Ovary cut transversely.

H. Echiteæ. *Anadendron Candolianum* (R.W.).

1. Expanded flower. 2. Detached corolla split open. 3. Calyx and stamens, after the removal of the corolla. 4. A detached stamen.

5. Two stamens and pistil. 6. Calyx cup-shaped, nectary and pistil in situ. 7. Detached ovary. 8. The same cut vertically.

9. Dissected seed, embryo in situ. 10. Detached embryo, albumen sparing.

CVI.—ASCLEPIADEÆ.

This very curious order of plants was in the first instance associated, by Jussieu, with his *Apocyneæ*. It was afterwards separated by Brown, previous to the publication of whose very lucid exposition in the memoirs of the Wernerian Society, the structure of the reproductive organs of this family were misunderstood and imperfectly described. He, by commencing his investigations at a very early stage of its existence, and tracing the progressive formature and development of the flower, was enabled satisfactorily to explain the true nature of its parts and the curious organization of this tribe. Here as in other plants we find the calyx and corolla developed in the usual forms, but not so the stamens, anthers and pollen, neither the stigma, which has a series of glandular appendages (corpuscules), not elsewhere observed, and which seem to perform a curious office in the function of reproduction. In this order the filaments usually cohere, forming a tube round the ovary; the anther, in place of forming a distinct head on the apex of the filament, is usually composed of 2 cells or sacks, one on each side, near the apex just under the edge of the broad stigma; the pollen, in place of being a small quantity of fine dust, lodged in the cells, is, for the most part, a solid waxy mass, connected with the stigma through the intervention of the corpuscules; the stigma itself is large and fleshy, bearing on its margin 5 shining gland-like corpuscules, each terminating below in two processes which, about the time of the expansion of the flower, become firmly attached to the apices of the corresponding pollen masses. Such, in a general way, is a description of what is to be met with in the flower of a genuine Asclepiadeous plant.

The tribe *Periploceæ* is somewhat different and in some respects more nearly approaches to the character of *Apocynaceæ;* though still very different, as I shall endeavour to show in the accompanying analysis.

Having premised these general descriptive details of the perfect flower, I shall add an extract from Mr. Brown's Memoir explanatory of the course pursued by him, in eliciting the information on which they are founded. He thus describes the flower of *Asclepias Syriaca*.

"The flower-bud of this plant I first examined, while the unexpanded corolla was yet green and considerably shorter than the calyx. At this period, the gland-like bodies which afterwards occupy the angles of the stigma were absolutely invisible; the furrows of its angles were extremely slight, and, like the body of the stigma, green; the antheræ, however, were distinctly formed, easily separable from the stigma, and their cells, which were absolutely shut, were filled with a turbid fluid, the parts of which did not so cohere as to separate in a mass; of the cuculli, which in the expanded flower are so remarkable, and constitute the essential character of the genus, there was no appearance.

"In the next stage submitted to examination, where the corolla nearly equalled the calyx in length, the gland-like bodies of the stigma were become visible, and consisted of two nearly filiform, light brown, parallel, contiguous and membranaceous substances, secreted by the sides of the furrow, which was now somewhat deeper: instead of the filiform processes, a gelatinous matter occupied an obliquely descending depression proceeding from towards the base of each side of the angular furrow.

"In a somewhat more advanced stage, the membranes which afterwards become the glands of the stigma, were found to be linear, closely approximated, and to adhere at their upper extremity. At the same time the gelatinous substance in the oblique depression had acquired a nearly membranaceous texture and a light brown colour, and on separating the gland from it furrow, which was then practicable, this membrane followed it. At this period, too, the

contents of each cell of the antheræ had acquired a certain degree of solidity, a determinate form, and were separable from the cell in one mass; the cuculli were also observable, but still very small and green, nearly scutelliform, having a central papilla, the rudiment of the future horn-like process. Immediately previous to the bursting of the cells of the antheræ, which takes place a little before the expansion of the corolla, the cuculli are completely formed, and between each, a pair of minute, light-green fleshy teeth are observable, the single teeth of each pair being divided from each other by the descending alæ of the antheræ. The glands of the stigma have acquired a form between elliptical and rhomboidal, a cartilaginous texture, and a brownish-black colour; they are easily separable from the secreting furrow, and on their under surface there is no appearance of a suture, or any indication of their having originally consisted of two distinct parts: along with them separate also the descending processes, which are compressed, membranous, and light brown; their extremity, which is still unconnected, being more gelatinous but not perceptibly thickened. The pollen has acquired the yellow colour and the degree of consistence which it afterwards retains. On the bursting of the cells, the gelatinous extremity of each descending process becomes firmly united with the upper attenuated end of the corresponding mass of pollen. The parts are then in that condition in which they have been commonly examined, and are exhibited in the figures of Jacquin, who, having seen them only in this state, naturally considered these plants as truly gynandrous, regarding the masses of pollen as the antheræ, originating in the glands of the stigma, and merely immersed in the open cells of the genuine antheræ, which he calls antheriferous sacs; an opinion in which he has been followed by Rottboell, Kœllreuter, Cavanilles, Smith, and Desfontaines. The conclusion, to be drawn from the observations now detailed, is sufficiently obvious; but it is necessary to remark, that these observations do not entirely apply to all the plants which I have referred to the Asclepiadæ, some of them, especially Periploca, having a granular pollen, applied in a very different manner to the glands of the stigma: they all, however, agree in having pollen coalescing into masses, which are fixed or applied to processes of the stigma, in a determinate manner; and this is, in fact, the essential character of the order. Dr. Smith, in the second edition of his valuable "Introduction to Botany," has noticed my opinion on this subject; but, probably from an indistinctness in the communication, which took place in conversation, has stated it in a manner somewhat different from what I intended to convey to him: for, according to his statement, the pollen is *projected* on the stigma. The term projection, however, seems to imply some degree of impetus, and at the same time presents the idea of something indeterminate respecting the part to which the body so projected may be applied. But nothing can be more constant than the manner in which the pollen is attached to the processes of the stigma in each species; and as considerable differences in this respect take place in various species, I have with advantage employed these in the new generic divisions of the order which I have attempted to establish, and to which I now proceed."

Character of the Order. Calyx 5-parted, sepals usually furnished with glands, at the base within; æstivation quincuncial. Corolla monopetalous, hypogynous, 5-cleft; throat naked or variously crowned with glands or appendages; below, more or less extensively adnate with the tube of the stamens; æstivation sub-valvate (the very edge overlapping and therefore, strictly speaking, imbricate), rarely contorted. Stamens 5, inserted into the base of the corolla, alternate with its lobes; filaments cohering, forming a tube round the pistil (Stylostegium or Gynostegium), rarely free; anthers erect, introrse, 2-celled or incompletely 4-celled, cells perpendicular or transverse, apex simple, truncated, acuminate, or fringed with a fine membrane. Pollen, at the period of the dehiscence of the anther, either cohering in masses equal to the number of the cells, or occasionally cohering in pairs, or four together, or granular: when simply equal to the cells, attached by pairs, one from each of two adjoining anthers, to the descending processes of the stigmatic corpuscules; when more numerous (as in Periploceæ), adhering to the dilated apex of the corpuscules. Ovaries two; ovules numerous, styles two, closely approaching each other, usually very short; stigma common to both styles, dilated, 5-cornered, the corners corpusculiferous; corpuscules either cartilaginous, bright shining brown, oblong, sulcated down the middle, and produced below into two slender processes (in Asclepiadeæ vere), or contracted below into a slender neck and dilated into a membranous expansion

above (as in Periploceæ). Fruit follicular, follicles 2 or 1, by abortion; placenta attached to the suture, separting in dehiscence. Seeds numerous, imbricated, pendulous, almost always comose at the hilum; albumen wanting or thin; embryo straight; cotyledons foliaceous; radicle superior; plumule inconspicuous.—Twining or erect shrubs with milky juice, or herbaceous, or very succulent perennials with watery juice. Leaves entire, opposite, rarely whorled; often furnished, at the insertion, with glands or hairs in lieu of stipules. Inflorescence extra axillary, racemose, corymbose or more generally umbelled. Flowers presenting various shades of red, yellow, or white, but rarely blue; sometimes fragrant, occasionally, as in nearly the whole tribe of *Stapelieæ*, exceedingly fetid like carrion.

Affinities. Most Botanists coincide with Mr. Brown in viewing this order as very nearly related to the preceding, the two principally differing in the peculiarities of their respective sexual apparatus. Alphonse De Candolle even goes so far as to affirm that the only constant difference between them is to be found in the pollen. In this, as stated above (see Apocynaceæ), I can scarcely coincide, viewing, as I do, the presence of corpuscules in this family as a more certain character, the pollen of *Crypotolepis* being about as distinctly granular as that of most *Apocynaceæ*. It forms no objection to this view that in the section *Periploceæ* the filaments are more or less free and do not form a true gynostegium any more than in *Apocynaceæ*, so long as they all, in common with true *Asclepiadeæ*, have the stigmatic corpuscules, though in a modified form. On these last, therefore, which are altogether wanting in *Apocynaceæ*, I lay greater stress than on the pollen, and the two together will, I believe, never disappoint us in determining to which of the two orders any doubtful plant should be referred.

Lindley takes a very different view of the relationship these two orders bear to each other, and places the one in his Gentianal the other in his Solanal alliance. He says, "It has already been stated under the order of Dogbanes *(Apocynaceæ)*, that the resemblances found between that order and the Asclepiads seemed to be one of analogy rather than of real affinity, for the economy of the flowers and seeds of the two orders is widely different. The amygdaloidal embryo of Asclepiads, with hardly a trace of albumen is entirely different from that of Dogbanes, which is very small and furnished with abundant albumen. The anthers and stigma of Dogbanes form no organic union, but they grow into one solid central mass in the Asclepiads, whence proceed other physiological and structural peculiarities." Again he says, "The reason why these great Botanists (Brown and De Candolle) attach small importance to the albumen as a distinction is doubtless because in certain Dogbanes, such as *Cerbera*, that secretion is absent, although in the mass of the order it is most abundant; but it is, I think, evident that the tendency among Dogbanes is to form albumen in abundance, and that no such tendency exists among Asclepiads." For these reasons he separates these generally supposed very nearly allied orders, placing the one, *Apocynaceæ*, between *Gentianeæ* and *Loganiaceæ*, in the same alliance with *Ebenaceæ* and *Ilicineæ*, and the other, *Asclepiadeæ*, between *Convolvulaceæ* and *Solanaceæ*, in the same alliance with *Oleaceæ* and *Polemoneaceæ;* the former because it has a tendency to form abundant albumen, the latter because no such tendency exists. Guided by the light he himself throws on the subject, I am disposed to think he attaches more importance to the existence or non-existence of albumen in theory than in practice, and often, in the former case, more than its actual value, so far as yet known, seems to justify. The character, as regards albumen, of his Solanal Alliance is, "embryo lying in a small quantity of albumen." Those of its orders as follows: 1st. *Oleaceæ*. "Seed with a dense, fleshy, abundant albumen." 2d. *Solanaceæ*. "Embryo straight or curved, lying in a fleshy albumen." The figure which accompanies shows abundant albumen. 3d. *Asclepiadeæ*. "Albumen thin." 4th. *Cordiaceæ*. "Albumen none." 5th. *Convolvulaceæ*. "Seeds with a small quantity of mucilaginous albumen." 6th. *Cuscuteæ*. "Seeds with fleshy albumen," and lastly, *Polemoneaceæ*. "Embryo straight in the axis of much fleshy albumen." I would here ask, if albumen is so important, on what principle is the first and last of these orders admitted into an alliance in which it is in small quantity or altogether wanting? But we can even go a step further, and inquire on what grounds the section, *Chionantheæ* of *Oleaceæ*, which is nearly exalbuminous, is permitted to retain its place in the order? I would further remark, that, in addition to several genera of *Apocynaceæ*, being destitute of albumen, many have it sparingly with a

large embryo. Similar discrepancies in regard to this point of the organization of plants, as compared with other indications of relationship, being frequent, it occurs to me, the only conclusion we can, in the present state of our knowledge, draw from them is, that the true value of characters derived from the albumen is still undetermined and that it is, to say the least, premature to attach to it so high a value as to break up generally recognized relationships, merely on account of variations of this single point of the organization. In saying this, I by no means wish to under estimate its value, as an ordinal or generic character, but adduce the facts here stated in support of the opinion expressed above (pages 130 and 131), that in groups higher than orders, it is a difficult subject to deal with, and requires to be used with caution. Influenced by these considerations, I am not prepared to adopt Dr. Lindley's views in regard to the affinities of this order, which I still think, notwithstanding its deficient albumen, much more nearly related to *Apocynaceæ* than to *Solanaceæ*, and moreover think, with Endlicher and Meisner, that a group, composed of *Oleaceæ*, *Loganiaceæ*, *Gentianeæ*, *Apocynaceæ*, *Asclepiadeæ*, and *Jasmineæ*, constituting, as thus arranged, a nearly perfect circle, forms a more natural association than those represented by either the Solanal or Gentianal alliances, as they now stand in Lindley's "Vegetable Kingdom," the only considerable intervals being between *Oleaceæ* and *Loganiaceæ*, and *Asclepiadeæ* and *Jasmineæ*, two orders, as already mentioned, whose immediate affinities are very obscure, but to my mind better placed here than anywhere else. They all have regular flowers, dicarpellary ovaries, and more or less copious albumen. Opposite leaves is the prevalent character of all, and nearly as much similarity of habit and properties pervades the group, as a whole, as we find in any of the families composing it.

Geographical Distribution. This is an order of great extent, including upwards of 1,000 species and has, over the warmer regions of the Earth, a proportionately extensive distribution. In Asia, Africa, and America, they abound; several are natives of Australia and the neighbouring islands, and a few extend to Europe. Africa, however, is considered the head-quarters, especially towards the southern promontory, where Stapelias are very numerous. In America the species are also very numerous, two large genera, *Asclepias* and *Gonolobus*, are principally confined to warmer North American States. Over India they are generally diffused, extending from Cape Comorin to high on the Himalayas where one species of *Ceropegia* luxuriates at an elevation of between 6,000 and 7,000 feet. In the peninsula, they are about equally numerous on the plains and sub-alpine jungles, and several are found on the Neilgherries at an elevation of between 7,000 and 8,000 feet, among which may be mentioned species of *Ceropegia*, *Tylophora*, *Gymnema*, *Cynoctonum* (formerly *Cynanchum*). Several *Stapelieæ* are common on the plains, thus associating the flora of India with that of Southern Africa. The number of species found in India amounts, I believe, to between 200 and 300, and many of them so common that they are met with everywhere, such as *Calotropis*, *Tylophora*, *Leptadenia*, &c.

Properties and Uses. The species of this family being, like their allies, the *Apocynaceæ*, distinguished by the very general presence of milky juices, are characterized by the possession of nearly similar properties. Acrimony is a general feature, hence many of them exhibit those poisonous properties which, in a milder form, give rise to the drastic and emetic qualities, so frequently met with in the order. In a few, these are so much reduced as to become innocuous, and admit of their being used as esculents. *Ceropegia edulis*, and *Oxystelma esculentum*, judging from their names, seem to be such. *Sarcostemma* (olim Cynanchum) *vimenale* is really such, the young succulent ramuli yielding a large quantity of mild, milky, acid juice, which natives suck to allay thirst, or eat as a sort of sallad: the *Gymnema lactiferum* is spoken of as the "cow plant of Ceylon," a designation to which, I fear, it is not entitled, as it is my belief, it is neither more nor less than *Gymnema sylvestre*, in which case its milk-yielding capabilities are vastly exaggerated. At the Cape, several species of *Stapelia* are eat both raw and cooked by the Hottentots. Those of this country are not, so far as I have heard, similarly employed, but perhaps might be. The taste of one of them, which I tried, is a peculiar bitterish acid,

certainly not, to my taste, pleasant. Among those used in medicine, *Calotropis gigantea* and *procera*, merit prominent notice, both, in addition to some specific properties, having been ascertained to possess in considerable vigour, those of Ipecacuana, as regards both its diaphoretic and emetic qualities. Another, not less estimable, on account of the same properties, is the *Tylophora* (Asclepias) *asthmatica* (Willd.), of the virtues of which Roxburgh speaks in very high terms. I subjoin, in a note, his account of it. *Hemidesmus indicus* merits attention as furnishing an excellent substitute for *Sarsaparilla;* and *Secamone emetica*, an allied genus, has the credit of being an efficient emetic. Ainslie states that the roots of *Gymnema* (Periploca) *sylvestris* are bitter, and supposed to be useful in cases of snake bite; for which they are prescribed internally in form of decoction, and the powder applied to the wound. They are also said to possess virtues similar in kind to Ipecacuana. These various instances tend to show the great similarity of the properties, generally found in plants of this order, to those of Ipecacuana. Several species are found useful in the arts. *Gymnema tingens*, and *Marsdenia tinctoria* yield a blue dye or Indigo; that obtained from the last is said by Roxburgh to be of excellent quality. The bark of *Marsdenia* (Asclepias, Roxb.) *tenacissima*, furnish fibres of great tenacity, and are employed by the natives of Rajamahl to make bow strings. *Cynanchum ovalifolium* (Wall.), a native of Penang, yields, according to Wallich, excellent Caoutchouc, so does *Cryptostegia grandiflora*, and probably several others. *Pergularia odoratissima* is greatly prized for the delightful fragrance of its flowers, as are some species of *Asclepias* for their beauty.

Remarks on Genera and Species. In an order, embracing within its limits nearly 150 genera, and above 1,000 species, there is doubtless ample scope for remark, but it is not my intention to enlarge under this head, the more so, as Decaisne has, in his recent monograph (see DC.'s Prod.), furnished a comprehensive summary of nearly all that is known regarding it. He divides the order into 5 tribes, analyses of four of which are given in the accompanying plates, 155 and 155–b. They are the following:

I. Periploceæ. Pollen masses 5–20, granulose, attached to the dilated or cuculate apex of the corpuscules of the stigma; filaments distinct above, or sometimes altogether free; anthers often bearded on the back; follicles divaricate. Twining shrubs.

The plant selected to illustrate this tribe is not perhaps the best that might have been taken, but was chosen as being an imperfectly known plant, omitted in DC.'s Prod., and as, apparently, forming the connecting link between this order and *Apocynaceæ*, having the granular pollen of the one and the corpuscules of the other.

II. Secamoneæ. Filaments connate; anthers 4-celled, glabrous; pollinia 20, small, erect, attached to the fleshy exsulcate apex of the corpuscules. Twining shrubs.

III. Asclepiadeæ veræ. Filaments connate; anthers 2-celled; pollinia 10, attached by pairs to the processes of the longitudinally-furrowed corpuscules of the stigma; *pendulous.*

This is a large group which M. Decaisne has found it necessary to divide into 8 minor ones, based on variations of the coronal appendage of the stamens.

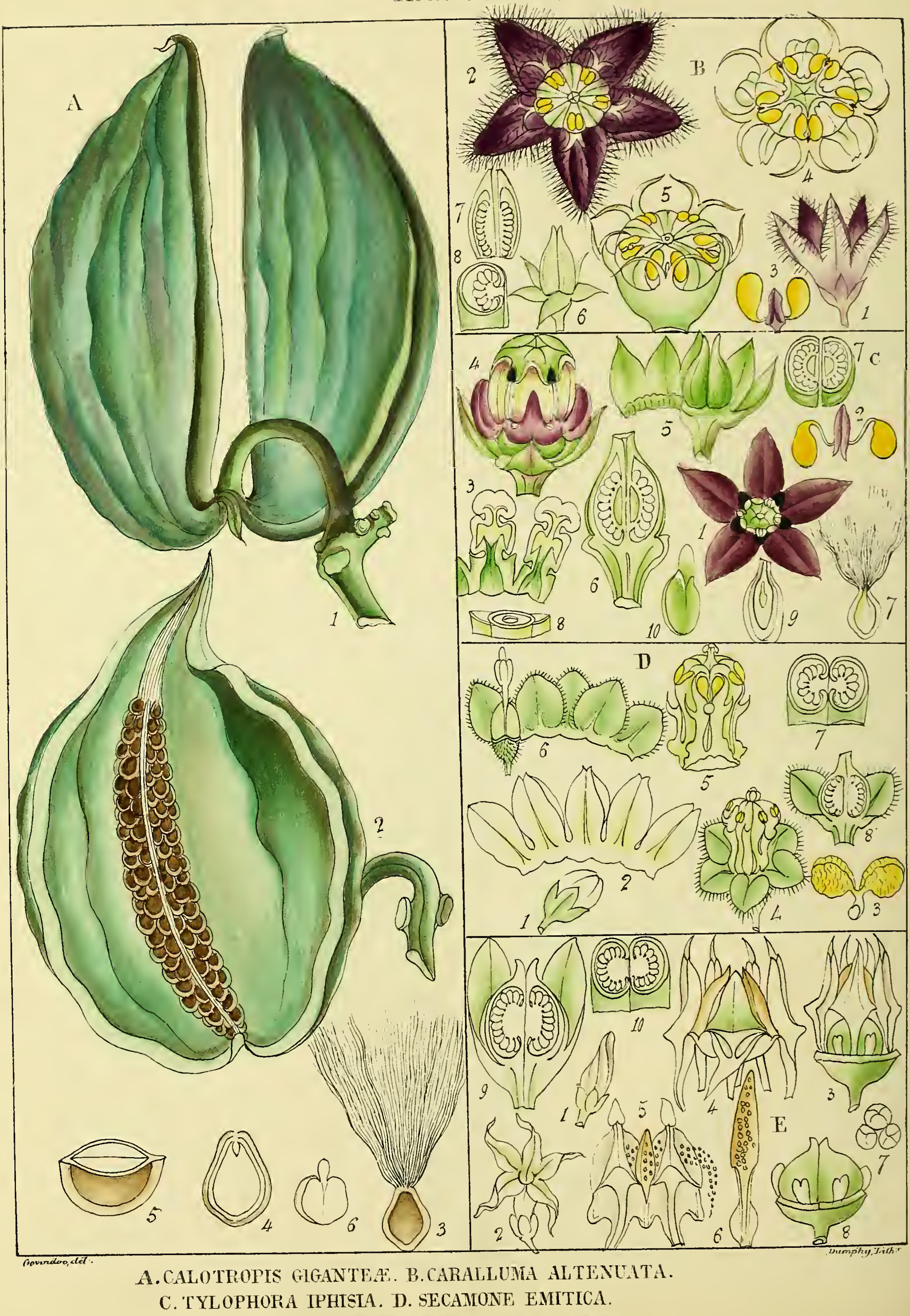
IV. Gonolobeæ. Filaments connate; anthers 2-celled, dehiscing transversely; pollinia 10, attached by pairs to the processes of the stigmatic corpuscules, transverse, usually pellucid on one side, and nidulating beneath the edge of the depressed, stellately-5-angled stigma. American plants.

There being no Indian species of this tribe, I have not introduced it into the plate.

V. Stapelieæ. Filaments connate; anthers usually terminated by membrane; pollinia 10, attached to the processes of the stigmatic corpuscules; *ascending* or *erect*, opaque, or often pellucid at the apex or one side, as if operculate. Fleshy herbs or twining shrubs.

This, like *Asclepiadeæ veræ*, is a large group, divided into two pretty nearly equal sections, according as the pollinia are altogether opaque or furnished with a pellucid margin or apex.

CALOTROPIS GIGANTEA (R.W)



A. CALOTROPIS GIGANTEÆ. B. CARALLUMA ALTENUATA.
C. TYLOPHORA IPHISIA. D. SECAMONE EMITICA.
E. CRYPTOLEPIS GRANDIFLORA.

It will be seen from these characters, all taken from peculiarities of the pollen, how valuable, even so minute a part of the organization becomes, towards systematic arrangement, when these peculiarities are constant in themselves, and easily definable.

Previous to the elaborate investigations of Mr. Brown, these had been in a great measure overlooked, and no two Botanists could agree as to the species referable to any of the then existing genera of the order. Dr. Roxburgh became so perplexed in his endeavours to refer the species known to him, to the then admitted genera, that he was at length constrained to cut the Gordian knot, by referring all the Indian species to Asclepias, a purely American genus, observing that "several of our Indian plants of this order hitherto consigned to *Pergularia*, *Periploca*, *Cynanchum*, and *Apocynum*, fall into this genus; nor can I contrive any possibility of placing them elsewhere, so exactly alike are all the essential parts of their *generic character*, which appears to me as completely *gynandrous*, as any of the *Orchideæ*." Influenced by these views, he referred all the species of the order (about 36) known to him to three genera, *Ceropegia*, *Stapelia*, and *Asclepias*. There are now about 200 described Indian species, each of which, under Brown's lucid arrangement, can be more easily made out than any of Roxburgh's 29 species of Asclepias, by being distributed, as they now are, under between 40 and 50 well-defined genera. The distinguishing marks of the modern genera are certainly very minute, and require the aid of a microscope to bring them to light, but with its assistance and a moderate degree of skill in the use of the instrument, they can for the most part be easily made out, and then their beauty and constancy amply repay the labour of their investigation.

EXPLANATION OF PLATE 155.

Calotropis gigantia (R. Br.).
1. Gynostegium.
2. Tube of the stamens split open and detached.
3. Stigma with its corpuscules and attached pollinia.
4. Detached pollinia.
5. Calyx and ovary.
6. Ovary cut vertically.
7. Transversely.

EXPLANATION OF PLATE 155-b.

A. 1. Fruit of *Calotropis gigantia* (R. Br.).
2. A follicle after dehiscence.
3. A seed and coma.
4. Seed, testa removed.
5. Cut transversely.
6. Detached embryo.

B. *Caralluma attenuata* (R.W.).
1. Flower seen from without.
2. From within.
3. Pollen masses and corpuscules.
4. Gynostegium seen from above.
5. Side view.
6. Ovary cut transversely.
7. Longitudinally.

C. *Tylophora Iphesia* (Dece).
1. Expanded flowers seen from above.
2. Pollen masses and corpuscule.
3. Detached stamens.
4. Gynostegium.
5. Calyx and ovary.
6. Ovary cut vertically.
7. Transversely.
8. A seed cut transversely.
9. Longitudinally.
10. Embryo detached and magnified.

D. *Secamone emetica* (R. Br.).
1. Flower-bud.
2. Corolla detached and split open.
3. Detached pollinia.
4. Gynostegium and calyx.
5. Stamens removed.
6. Ovary cut vertically.
7. Transversely.

E. *Cryptolepis grandiflora* (R.W.).
1. Flower-bud.
2. Expanded flower.
3. Gynostegium.
4. Same partially dissected.
5. Detached stamens and corpuscules.
6. Detached corpuscule.
7. Grains of pollen.
8. Ovary and hypogynous scales.
9. Ovary cut vertically.
10. Cut transversely.

CVII.—LOGANIACEÆ.

Many of the genera now congregated within the limits of this little order, were, in the first instance, referred to *Cinchonaceæ*, *Apocynaceæ*, and *Gentianeæ*. Mr. Brown was the first to point out the necessity for the separation of these outlying plants, and reunion in a distinct family. Since then all Botanists have adopted the suggestion, but with various modifications, according to their respective views, in which no two seemed quite agreed, until, at length the two De Candolles, father and son, took it in hand, defined its limits, and brought together, into one view, its scattered genera and species. As left by them it is a complex one, they having found it necessary to distribute its 26 genera, and 100 species, under no fewer than 4 sub-orders and 12 tribes. In its relationships it seems equally complex, parts of it associating almost as nearly with *Cinchonaceæ*, *Apocynaceæ*, and *Gentianeæ*, as with each other. Such being the case it seems not improbable that, in the event of future researches adding considerably to the number of species, it will yet be divided, by the elevation of some of the present sub-orders to the rank of orders. As it now stands it is a most difficult one to deal with, each positive character apparently having its negative one; thus we find among its species considerable sized trees and minute herbs, not 3 inches high; some with stipules some without; æstivation valvate or imbricate; flowers regular or irregular; stamens equaling the lobes of the corolla or unsymmetrical; style continuous or split at the base, and again united at the apex; ovules many or few; and lastly fruit capsular, drupaceous, or baccate. From this it would appear that its species are to be ascertained as much by negative as by positive characters. Some at first sight have the appearance of *Cinchonaceæ*, but with the ovary superior; some are like *Apocynaceæ*, but probably have stipules and watery not milky juices, and want the contraction in the middle of the stigma; others resemble *Gentianeæ* but have stipules and deciduous corollas, with valvate not twisted æstivation.

The following is De Candolle's.

Character of the Order. Calyx free, 5- rarely 4-lobed. Corolla regular or rarely irregular, hypogynous, 5- rarely 4-lobed, or many-lobed; æstivation valvate, twisted, or imbricated. Stamens inserted on the tube of the corolla, sometimes 5, alternate with the lobes, or rarely 1, or 10, or 12, then (in Potalia) opposite the lobes; or lastly (in Sect. 2d of *Gærtnera)*, 3 alternate and 2 opposite the lobes of the corolla; anthers 2-celled, dehiscing lengthwise; pollen (ex Martius) vittato-three-lobed. Nectary (the last tribe excepted) none. Ovary free, 2- rarely 3-celled or 1-celled. Ovules amphitropous or rarely (in *Gærtnera*) anatropous, style simple; stigma simple or two-lobed. Fruit sometimes capsular, the margin curved inward, and bearing the placentas; sometimes drupaceo-baccate. Placentas in the capsules often at length free. Seed usually peltate, rarely erect, sometimes winged; albumen fleshy or cartilaginous; embryo straight with the radicle next the hilum; cotyledons 2, foliaceous.—Shrubs or small trees, rarely herbs. Leaves opposite, entire, penninerved, petioled. Stipules between, or within the petioles, often united into a sheath, sometimes wanting. Flowers racemose or corymbose, rarely solitary, terminal or axillary.

Affinities. These fluctuate between *Cinchonaceæ*, *Apocynaceæ*, and *Gentianeæ*, to each of which they approach so nearly that it is often difficult to distinguish between them. As regards the first, most Botanists view them, with reference to their structural characters, as *Cinchonaceæ*, with superior free ovaries, but they differ widely in their properties, while as relates to *Apocynaceæ*, Alph. De Candolle states that he has sought in vain for a positive distinction to which there shall be no exception, but while botanical distinctions are thus wanting their properties are more in accordance. As his remarks on the two orders are most instructive, I shall quote the passage entire as translated by Lindley.

"I must confess that I have sought in vain for a positive distinction, to which there shall be no exception, between Dogbanes and Loganiads. The position of the flower with respect to the axis appears to be the same, that is to say, a re-entering angle of the calyx stands next the

axis. That of the cells of the fruit with respect to the axis varies among Loganiads, as does the æstivation of the corolla and many other characters. The grains of pollen are not very different, if we rely upon the exact but scanty observations of Mr. Hassall. The placentas of Dogbanes are more securely fastened to the edges of the carpillary leaves, and do not separate from them when the fruit is ripe, as generally happens more or less distinctly among Loganiads; but the placenta of Strychnos is exactly that of Carissa. Dogbanes have a milky juice; but exceptions to that are said to occur, as in Echites, for instance. Finally, the only differences which I can point out are of a particular kind, not very satisfactory in practice, although of some value in botanical philosophy. These reside in the nature of the variations presented by Dogbanes and Loganiads. In the former the flowers are always isomerous in the calyx, corolla, and stamens, and the number is never more than 5; in the latter the corolla and stamens have sometimes more pieces than the calyx, as in Potalia; the stamens are sometimes reduced to one, as in Usteria. The stamens of Dogbanes always alternate with the lobes of the corolla; those of Loganiads vary more or less from this position, and become opposite in Potalia. In Dogbanes, the number 2 in the carpel is without exception; in Loganiads, one genus, Labordia, has 3 cells.—In Dogbanes, the æstivation of the corolla is always twisted, except in Mascarenhasia, where it is enduplicato-valvate with a torsion of the back of each lobe, which indicates the tendency of the order; in Loganiads the æstivation is very variable, and is often valvate in the strictest acceptation of the term.—Dogbanes often have hypogynous glands or a complete disk; Loganiads have not a trace of either. The first have often appendages inside the corolla; the second never have any, unless we so consider the hairs which guard the orifice. The stigma is often of considerable size, and bears a peculiar kind of gland in Dogbanes; Loganiads have no such appearances." "This last is the true distinguishing character." Lindley.

The tribe *Spigelieæ* differs considerably in habit from the rest of the order, fluctuating between *Heyotideæ* of *Cinchonaceæ* and *Gentianeæ*. Most Botanists seem to think it most nearly allied to the latter, and have described its genera under that order, but Griesbach is disposed to take the opposite view, thinking them more allied to the former.

Geographical Distribution. Tropical or sub-tropical plants, a few only of the herbaceous forms extending to any considerable distance beyond. Wallich found a *Gardneria* in Nepal, and another is found at an elevation of between 6,000 and 7,000 feet on the Neilgherries, but these may almost be viewed as exceptions to the general rule. In Malacca, Mr. Griffith found a species of *Antonia*. Both the other species are from Brazil.

Properties and Uses. These are of the most active and energetic description, more especially numerous species of *Strychnos*, which, in any but the smallest doses, are intensely poisonous, producing violent spasms and convulsions of the voluntary muscles. This last property has been taken advantage of in the case of *S. nux vomica*, the alkaloid of which (Strichnine) is frequently administered in paralytic affections, but on account of the intensity of its action always with some degree of risk. Of the other species, *S. Tieute* and *toxifera* merit especial notice on account of their frightfully venomous qualities. From the roots of the former a very potent poison is extracted in Java, and from the latter, the not less destructive *Wooraly* or *Ourari* poison of South America. Dr. Hancock considers this last the most powerful sedative in nature. The wood of the *S. nux vomica*, particularly that of the root, is very bitter, and is used in the cure of intermittent fevers and the bites of venomous snakes; and Dr. Fleming informs us that in upper India distillers occasionally introduce the seed to render their spirits more intoxicating. It seems curious that the pulp of the fruit of this tree, everywhere else so poisonous and destructive of animal life, should seem innocuous, at least to birds, many of which devour it greedily. The seed of *Strychnos potatorum* (clearing nut), are everywhere employed to clear muddy water which they effect by merely rubbing the inside of the vessel with them. It is difficult to account for their modus operandi, but their possession of this property is everywhere admitted. Nothing seems known of the properties of the other Indian species of this order.

Remarks on Genera and Species. The complexity of this order, as regards its structural peculiarities, has been already adverted to. With the view, therefore, of more clearly explaining

these, than by description only, I have in the accompanying plates given analyses of three of its four sub-orders, and of 6 of the 12 tribes under which DC. has distributed the species. The remainder, not having representatives in the Indian flora, are excluded. The following are De Candolle's characters of the sub-orders and tribes here shown, with the names of the genera employed to represent them.

Sub-order (and Tribe) I. Spigelieæ. Flowers isomerous; æstivation of the corolla valvate. Capsule didymous, many-seeded, seeds wingless; embryo small; cotyledons scarcely conspicuous. Herbaceous plants; leaves sometimes exstipulate. *Mitrasachme Mitreola.*

Sub-order II. Strychneæ. Flowers isomerous, æstivation of the corolla valvate. Embryo conspicuous. Trees or shrubs.

Tribe II. *Eustrychneæ.* Berry or drupe two-celled, many-seeded; sometimes by abortion one-celled and one-seeded. Seeds peltate, wingless. *Strychnos.*

Tribe III. *Gardnerieæ.* Berry 2-celled and 2-seeded. Seed peltate, wingless. *Gardneria.*

Tribe IV. *Antonieæ.* Capsule 2-celled, bipartible, septicidal, dehiscing from the apex. Seed few in each cell, peltate, winged. *Antonia.*

Sub-order III. Loganieæ. Flowers isomerous, corolla convolute in æstivation. Shrubs or herbs. Stipules sometimes wanting.

Tribe X. *Fagrœaceæ.* Fruit baccate. Seeds numerous, wingless. *Fagrœa.*

Tribe XI. *Gœrtnereæ.* Ovules anatropous. Berry dicoccous, cocci 1-seeded. Seed erect from the base. *Gœrtnera.*

A comparison of the characters of the Tribes, here placed in strong contrast, will show at once how difficult an order this must be to deal with. The first tribe is closely related to *Gentianeæ* in habit, structure and properties; the second and third to *Apocynaceæ*; the fourth leaning towards *Bignoneaceæ* in its winged seed, and *Sesameæ*, in the peculiarly inflexed margins of the valves of the capsule: the tenth approaches *Bignoneaceæ* in the form of its flowers, and the eleventh almost unites *Loganiaceæ* and *Cinchonaceæ*, through the tribe *Coffeaceæ* of the latter.

EXPLANATION OF PLATE 156.

1. *Strychnos potatorum.* Flowering branch, natural size.
2. Unopened flower in bud.
3. 4. Open flower, side and front views.
5. Corolla detached and split open.
6. Anthers.
7. Detached ovary and calyx.
8. 9. Ovary cut transversely and vertically.
10. Mature fruit.
11. 12. Cut transversely and vertically, 1-seeded.
13. Seed natural size.
14. Testa removed and lobes separated to show the plumule.
15. Radicle and plumule detached.

EXPLANATION OF PLATE 156-b.

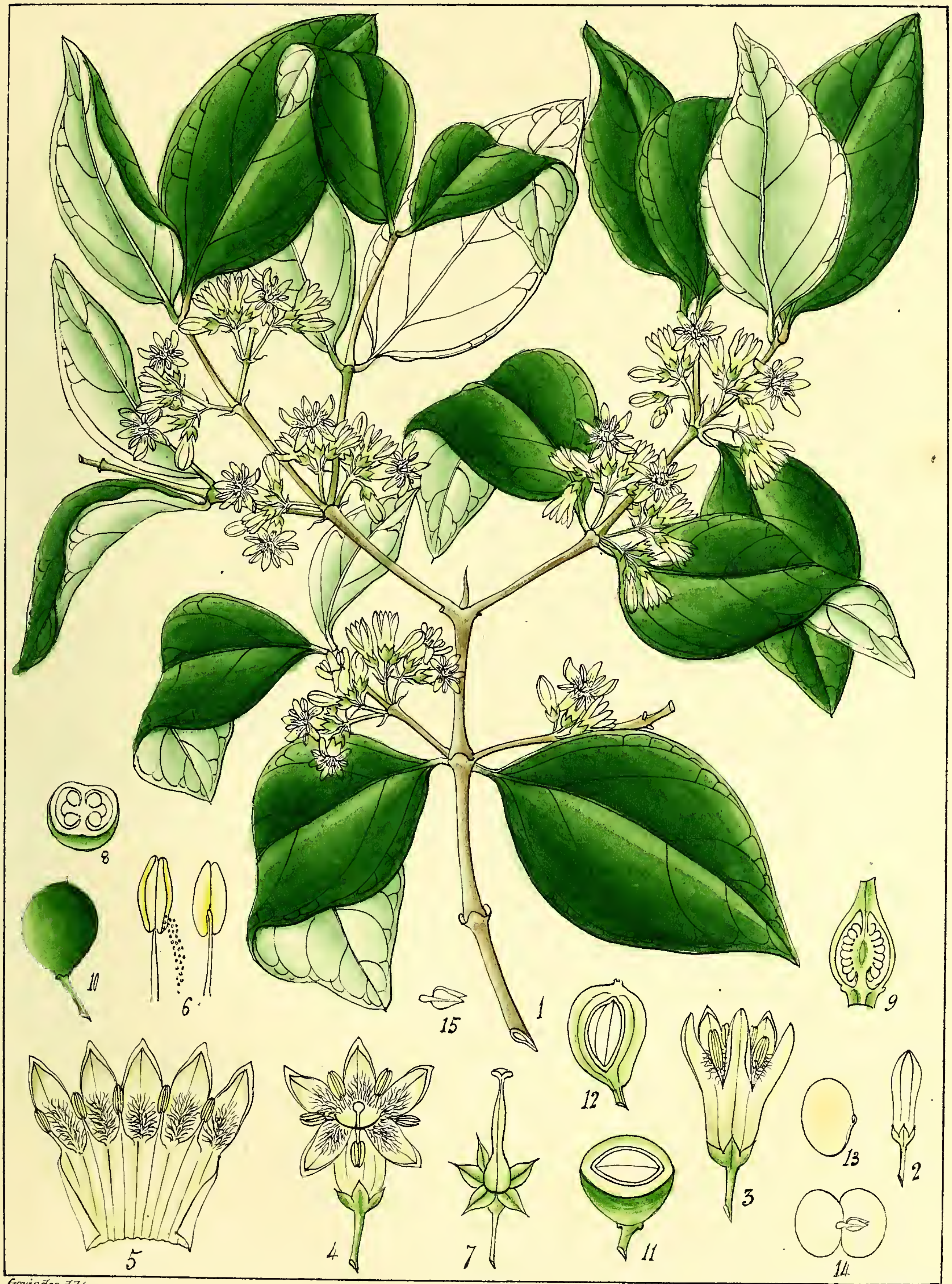
I. 1. *Metrasachme India* (R.W. Ic. 1601), nat. size.
2. Detached flower.
3. Corolla split open.
4. Stamens, back and front views.
5. Calyx and ovary.
6. 7. Ovary cut transversely and vertically.
8. Mature capsule.
9. 10. Cut lengthwise and transversely.
11. Seeds.
12. Magnified section of the stem.
13. Leaves magnified.
14. Section of the stem of *Met. Malaccensis* (R.W. l. cit.)
15. Flower of *Mitreola paniculata* (Wall.).
16. Corolla detached and split open.
17. Stamens, back and front views.
18. Ovary and calyx.
19. Mature capsule.
20. Divided vertically.
21. Detached seed.

II. *Gartnœra Walkeri* (Arnott).
Parts shown as above.

III. *Fagrœa Coromandeliana* (R.W. Ic.).

IV. *Antonia Griffithii* (R.W.), ramuli petiols and inflorescence velutinous; leaves coriaceous, obovato-oblong, ending in a short blunt acumen, glabrous on both sides: corymbs dense, sub-capitate; flowers minute, capsule pear-shaped, obtuse. Malacca, Griffith. "Genus nov. *Usteriæ propinquum.*" Griff. MSS. This is I think an undoubted *Antonia*, and quite different from both the Brazilian species.

V. *Gardneria Wallichii*, R.W. in Wall. Plant Asiat. rariores.
Dissected as above.



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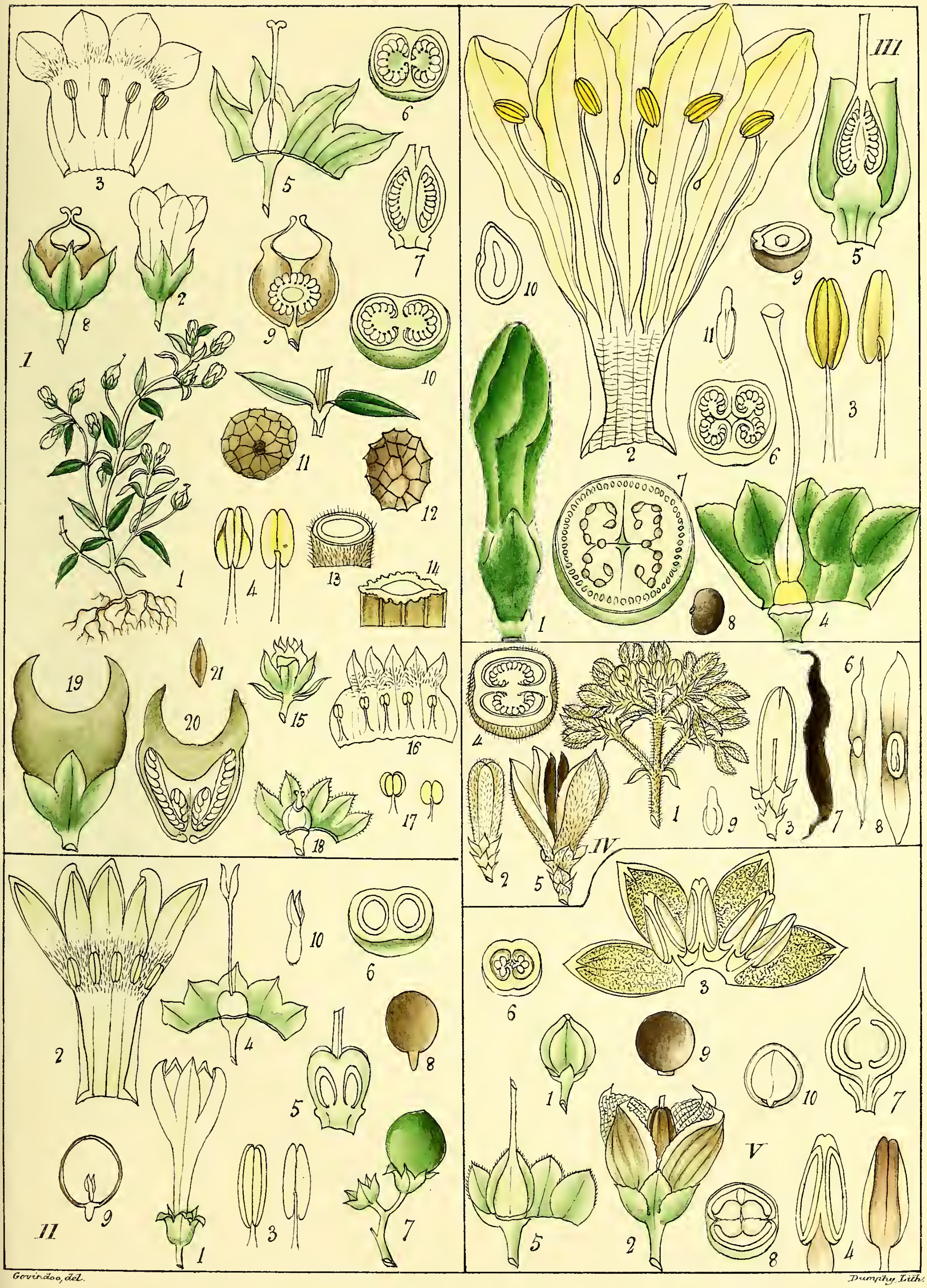
STRYCHNOS POTATORUM (ROXB)



I. SPIGELICÆ. II. GÆRTNEREÆ. III. TAGRÆACEÆ.
IV. ANTONIEÆ. V. GARDNERIEÆ.

CVIII.—GENTIANACEÆ.

This large order of herbaceous plants, being for the most part extratropical, was first defined by Jussieu, and so accurately that all his genera, with two or three exceptions, are still retained. Brown afterwards revised the character, and removed one of Jussieu's genera, but placed in it one or two others *(Mitrasacme* and *Logania)*, since removed to *Loganiaceæ*, not, however, without indicating that the last might, with some others named, be separated to form the type of the order since adopted. This is an interesting order, owing to the extent of its geographical distribution, extending from the regions of perpetual congelation to the hottest sands of the tropics; the diversity of its colours, and the uniformity of its sensible properties. Griesbach has recently revised the order with much care for DC.'s Prodromus.

Character of the Order. Calyx free, persistent, 4–5-lobed, rarely 6–12, sepals cohering, valvate in æstivation. Corolla monopetalous, hypogynous, persistent, regular, or bilabiate in *Canscora*, the lobes alternate with the segments of the calyx, contorted to the left in æstivation, induplicate in *Menyantheæ*. Stamens inserted on the tube of the corolla, alternate with its lobes; filaments free; anthers 2-celled, erect or incumbent, occasionally at length twisted. Ovary single, one-celled, composed of 2 carpels with intro-flexed margins, hence half two-celled; ovules numerous, anatropous, attached to the margins of the valves; style simple, stigmas two or one. Capsule one or imperfectly 2- or 4-celled, septicidal, placentas parietal. Seed usually numerous; albumen fleshy; embryo axile, minute, cylindrical, straight; radicle thickened, directed to the hilum; cotyledons fleshy, short.—Herbaceous or frutescent plants, usually glabrous, bitter, not milky. Leaves opposite, rarely alternate, simple 3–5-ribbed, entire or 3-lobed, in *Menyanthes*, exstipulate, petioles often confluent at the base. Flowers terminal, or axillary, regular or rarely irregular. [In *Ophelia* there are 4 carpels as shown by the 4 placentæ.]

Affinities. Nearly all Botanists seem now agreed in associating this order as it is here placed, viewing the three preceding orders as its nearest allies. Brown at first supposed it most nearly allied to *Scrofulariaceæ* and *Polemoniaceæ*. Whether his views continue unchanged I am unable to say, but presume that the additional light which has been thrown on botanical affinities, to which he has himself so largely contributed, has tended to produce some alteration. Lindley considers them nearly allied to *Apocynaceæ*, and collaterally to *Solanaceæ*, from which last and from *Scrofulariaceæ*, he considers it cut off by the placentation. I say "collaterally" with *Solanaceæ* because he does not even mention that order under *Gentianaceæ*, but remarks of the Gentianal Alliance, "that it touches Solonals at Nightshades themselves, which, if they had parietal placentæ, might often be mistaken for Gentianworts; and at Dogbanes whose minute embryo offers one of the principal reasons for not associating them in the same alliance with Asclepiads." I do not myself coincide with him in either of these examples, but probably would not have ventured to express an opinion in opposition to such a master of the science had I not been borne out by the nearly general sense of Botanists.

Geographical Distribution. In the extent of its geographical distribution, this is a very remarkable family, its species extending from the regions of almost perpetual congelation of either pole to the equator, where they are found luxuriating in arid sandy plains. The genus *Gentiana* is especially remarkable for the width of its geographical range, extending from the Arctic to the Antarctic circle; nay more, a single species *(Gent. prostrata)* "has a most extraordinary range both in latitude and longitude. In Southern Europe it inhabits the Carpathian Alps between 6,000 and 9,000 feet high; in Asia, it has been found on the Altai Mountains about N. lat. 52°. Its American range is much more remarkable, it having been gathered on the tops of the Rocky Mountains in lat. 52° N. where they attain an elevation of 15,000 to 16,000 feet; and on the east side of the Andes of South America in 35° South: it descends to the level of the sea at Cape Negro, in the Straits of Magellan in lat. 53 S.; and at Cape Good Hope in Behrings Straits in lat. 68½° North."—*J. D. Hooker.* Several species of Gentiana, are

found on the Himalayas, but only one, so far as I am aware, extends to Southern India, and these only met with on tops of the highest mountains. Species of *Exacum* extend from the level of the sea to the highest tops of the Neilgherries; the *Canscoras* are all natives of the plains, or of lower elevations; the *Ophelias*, several of which are found in the peninsula, inhabit the mountain tops, as does *Halenia*, a nearly allied genus. The aquatic genera, *Villarsia* and *Limnanthemum*, I have always found on the plains.

Properties and Uses. On this subject Lindley well remarks, that "the order of *Gentianeæ* is not more remarkable for the diversity of its colours, than it is for the uniformity of the secretions which its various species exhibit. Bitterness in every part, roots, leaves, flower, fruit, in annuals perennials and shrubs, is so much their characteristic, that the following account of the purposes to which they are applied is little more than a list of repetitions; with this exception, that they in some cases prove narcotic and emetic."

The properties of the Indian species, with the exception of a few of the northern ones, seem to have been scarcely if at all investigated, as I do not find a single notice regarding them, but I know that they do not depart from the general characteristics of bitterness as I have tasted many. Neither have I in this country seen them in cultivation as garden ornaments, though several merit the distinction, especially the Exacums, which replace in this country the Gentians of Europe. Their colours as indicated, in the above extract, by Dr. Lindley are various and striking; red, purple, blue, yellow, and white all occur, and in one Indian species, *Exacum bicolor*, blue and white are blended, the tube of the flower being white, and the tips of the lobes blue. The flowers of the little Neilgherry Gentian are deep-blue, and so likewise are those of the much-more-conspicuous and showy *Exacum Perrottetii*, a most ornamental plant, but rarely met with in gardens. The Ophelias too are all showy plants, and with a little care might be rendered very ornamental additions to the flower garden.

Remarks on Genera and Species. To this order appertains about 60 genera, and nearly 500 species; of these 12 or 13 genera, and about 100 species are found in India. Griesbach divides the order into two tribes, *Gentianeæ veræ* and *Menyantheæ*. The first of these tribes he further divides into 4 sub-tribes, three of which have Indian representatives. For the purpose of conveying as perfect an idea of the whole order, as can be done in small space, I have selected small plants for representation in the supplementary plate, and in that way have been enabled to illustrate both the tribes and three of the sub-tribes in a single plate. Those wishing further information will find figures of 20 additional species in my Icones. Regarding the plant figured in the Icones under the name of *Halenia Perrottetii*, I may here remark that I have, since its publication, ascertained it is not that species but *H. elliptica* (or a nearly allied species) which thus, if really identical, proves to be a native of both the Himalayas and Neilgherries. Still further to correct the previous error, I have given a figure of what I consider the true plant in the accompanying plate, No. 157. The following are Griesbach's characters of the Tribes and Sub-tribes illustrated.

Tribe I. *Gentianeæ*. Æstivation of the corolla twisted to the left. Testa membranaceous. Terrestrial herbs, or rarely shrubs. Leaves opposite (very rarely alternate), entire.

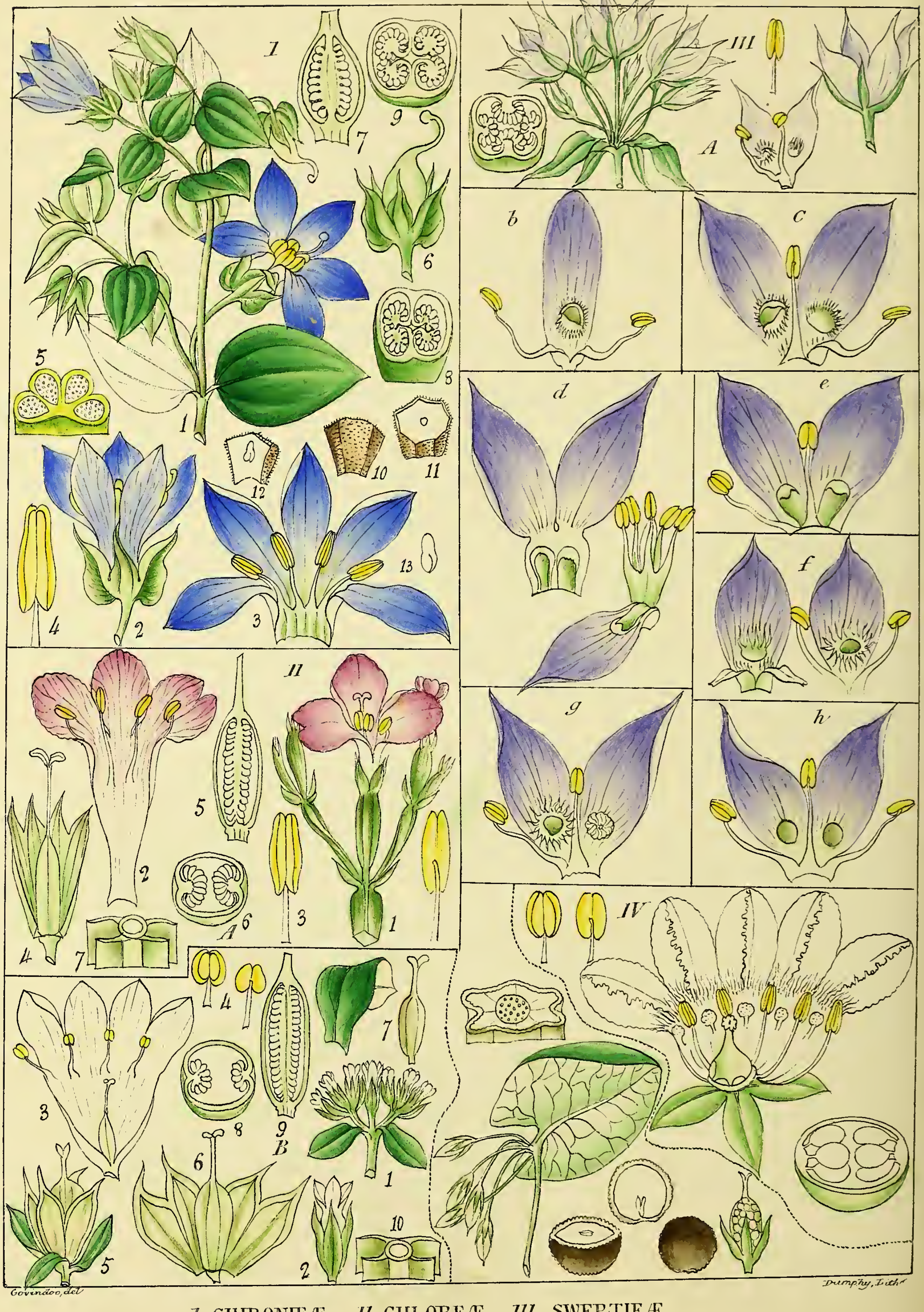
Sub-tribe I. *Chironieæ*. Cells of the anthers erect, without a connective, hence dehiscing by short, pore-like slits, often contiguous at the apex. *(Exacum Perrottetii.)*

Sub-tribe II. *Chloreæ*. Anthers furnished with a connective, at length recurved or spirally twisted. Style distinct, deciduous. *(Canscora alata* and *Cicindea fastigiata.)*

Sub-tribe IV. *Swertieæ*. Anthers furnished with a connective, remaining unchanged. Stigma persistent, sessile, or the style persistent and confluent with the lobes of the stigma. *(Halenia Perrottetii*, and several species of *Ophelia.)*

Tribe II. *Menyantheæ*. Æstivation of the corolla induplicate. Epidermis of the testa ligneous. Herbaceous, aquatic or marsh plants. Leaves alternate, sheathing. *(Limnanthemum cristatum.)*

Under these divisions 44 genera are arranged, with a few only of which I am acquainted, but, slender as my acquaintance is with the order, as a whole, I cannot help thinking that some



I. CHIRONIEÆ. II. CHLOREÆ. III. SWERTIEÆ.
IV. MENYANTHEÆ.

HALENIA PERROTTETII (GRISEB)

of these genera are either unnecessary or inadequately defined. Between *Ophelia* and *Swertia*, for example, if really distinct, the distinguishing characters do not seem well brought out, neither do those between *Canscora* and *Pladera* seem quite satisfactory, while, judging of *Cicendia* from *C. fastigiata*, I can discover no difference between it and *Pladera*. It is true that none of these genera are his and to that extent he is not accountable for them, but it does appear to me that, when revising a whole order, and reconstructing the characters of its genera, the author is not bound to preserve genera originally based on imperfect observation and perhaps bad materials, or on insufficient examination. The genus *Ophelia*, as it now stands in DC.'s. Prod., is a very difficult one. This, I believe, is in some measure owing to Griesbach having unfortunately selected, as the basis of his divisions, the form of the filiments which, according to my experience, do not supply good sectional characters, being with a few exceptions all too much alike. The form of the pores and their appendages seem better adapted for the purpose, as being more easily appreciable and more constant. In some, for example, the pore is completely covered with a scale larger than itself, and nearly entire or slightly fimbriated on the margin; in others the scale is smaller and fimbriated on the margin with long bristles or lacineæ; and in others again it is attached to the upper half of the pore, entire on the margin, and pendulous like a curtain; and lastly a few have no proper pore, its place being supplied by a glandular thickening. Availing ourselves of such marks as these, the genus might be divided as follows:

Pore covered by a scale, free on the margin.
  Scale attached to the lower edge of the pore, ascending. (Figs. b. c.)
  Scale attached from above, entire on the margin, pendulous. (d. e.)
Pore not covered with a scale but bound by a raised margin.
    Margin broad, sub-saccate, beset on the edge with long, coarse bristles, concealing the pore. (f.)
    Margin narrow, bristles short, inflexed over the pore. (g.)
Pore wanting, its place supplied by a naked, glandular disk, or by minute, inconspicuous dots. (h.)

This example will, I trust, suffice to show the use that might be made of that organ in distributing into sections the species of this very difficult genus. The author of the monograph does not seem to have observed this point of structure with adequate care as it strikes me I more than once, when studying the genus, stumbled on cases where the pores were incorrectly described, conveying the impression that he thought them of but small value in furnishing specific characters.

Before quitting *Ophelia*, I would direct attention to the section of the ovary as exhibiting an example of 4 placentæ and, according to the view I take of that structure, indicating a like number of carpels. It is with reference to this peculiarity that I made the addition, within brackets, appended to the character of the order.

EXPLANATION OF PLATE 157.

Halenia Perrottetii (Griseb.) nat. size.
1. Unopened flower.
2. Flower full-blown.
3. Detached corolla split open, stamens in situ.
4. Anthers, back and front views.
5. Calyx and ovary.
6. Ovary detached and magnified.
7. Ovary cut transversely.
8. The same enlarged and forcibly dilated to separate the approximated, but not adhering, inflexed margins of the carpels, forming, in this genus, a spurious partition.
9. Ovary cut lengthwise.
10. Mature capsule, a little enlarged.
11. Seed much magnified.
12. Cut vertically, embryo in situ.
13. Detached embryo.

EXPLANATION OF PLATE 157-b.

I. Exacum Walkeri, Arnott.—5. transverse section of an anther, highly magnified—the other numbers as usual.
II. A. Canscora alata, fig. 6. section of the stem showing the wings.
  B. Cicendia fastigiata, or Pladera pusilla.
III. a. Ophelia umbellata (R.W. Herb.).
  b. Ophelia affinis (W. & A. MSS.).
  c. Ophelia Lawii (W. & A. MSS.).
  d. Oph. purpurascens (Don).
  e. Oph. Dalhousiana (Griseb.).
  f. Oph. alba (W. & A. MSS.).
  g. Oph. trichotoma (W. & A. MSS.).
  i. Oph. cordata (Don).
IV. Limnanthemum cristatum.

CIX.—OROBANCHACEÆ.

This is a curious order of leafless, parasitic plants growing on, and drawing their nourishment from, the roots of others, just as *Loranthaceæ* grow on and obtain their nourishment from the stems and branches of those to which they attach themselves. Its proper place in the vegetable system is still undetermined; some Botanists viewing it as most nearly related to *Scrofulariacæ*, others to *Gesneriaceæ*, and others to *Gentianeæ*. For myself I certainly coincide with those who consider it most nearly related to *Gesneriaceæ*, as now limited by Endlicher and Brown. Both orders have unsymmetrical, more or less perfectly personate flowers; didynamous stamens; one-celled ovaries with deeply-inflexed, carpillary, placentiferous margins; anterior and posterior carpels; and seed more or less albuminous. *Gentianeæ*, while agreeing in the general structure of the ovary and seed, differ in having regular, symmetrical, not personate flowers. The exact value of this last character may perhaps be disputed, but if it holds good in one case it should in another, and, if I do not mistake his meaning, Lindley separates, to a considerable distance, *Scrofulariaceæ* from *Solanaceæ*, on that ground. They differ in the structure of the ovarium and placentation from *Scrofulariaceæ*, which have a two-celled ovary with strictly axile placentation. Influenced by these views, it appears to me that *Orobanchaceæ* naturally fall into this place, as having very nearly the ovarial structure of the *Gentianeæ*, while it coincides with *Gesneriaceæ* in the form of the flowers, structure of the ovary and, in part at least, in that of the seed.

Before proceeding to detail the characters of the order as given by Reuter (DC. Prod. Vol. 11.), the last writer on the family, I shall introduce an extract, bearing on the subject, from some remarks published in the 4th Vol. of my Icones, which, though drawn from a comparatively limited series of observations, may still, with the aid of analysis, be useful in assisting those having to work with imperfect materials to understand this difficult family.

"As I understand the order, the parts of which it is made up are held together more by habit than structure, namely, 'Herbaceous, leafless plants, growing parasitically on the roots of other species; stems covered with brown or colourless scales.' Characters taken from the flowers are variable or common to several other families, those taken from the stamens and style are of a conflicting kind, and so also are those obtained from the ovary and fruit, but it is on these last that I think the greatest reliance can be placed in grouping the species.

"The characters of the order may be thus briefly stated. Calyx tubular, or, as in *Orobanche* and *Æginetia*, wanting, its place being supplied in the former by the bracteoles, and in the latter by a spathe. Corolla more or less irregular, tubular. Stamens didynamous, usually incluse; anthers either perfect with 2 parallel polleniferous cells, or imperfect, one of the cells being sterile or altogether wanting. Ovary superior, 1-celled, or spuriously 2-celled or, rarely, perfectly 2-celled; composed of 2 or 4 or more carpels, usually placed, when two, anterior and posterior to the floral axis, with the placentæ right and left; ovules very numerous. Fruit a capsule; dehiscence loculicidal. Seed small, testa spongy, scrobiculate; embryo minute, at the base of fleshy albumen. Of these characters those derived from the seed, taken in connexion with the habit of the plants, will be found most constant. The placentation differs in the different groups and has furnished the basis for the following division of the order into sections or sub-orders. In *Orobanche*, for example, it consists of from 4 to 6 prominent parietal lines, each covered with numerous ovules. In *Phelipæa ramosa* and *Lathræa squamaria* (respectively the types of these genera), the carpels coalesce at the points of junction, but the placentiferous margins remain free, and are afterwards reflected to the right and left, but do not meet in the centre; hence the ovary is only one, or half 2-celled. In *Æginetia* the placenta consists of two intricately lamellated bodies, and in *Oligopholis* of two solid, fleshy ones which, in both cases, nearly fill the whole cavity and are covered on all sides with ovules, but in neither cohere, so as to form a central partition between the 2 carpels. And lastly, in *Hyobanche*, the inflexed portions of the carpels do partially meet in the axis, forming a spuriously 2-celled ovary, but the placentiferous margins still remain free and, being reflexed, form 2 loose placentæ in each cell."

Character of the Order. Flowers irregular. Calyx free, persistent, 4–5-sepaled; sepals cohering into a 4–5-cleft calyx, or united by pairs. Corolla monopetalons, hypogynous, pentamerous or, by union of the upper pairs, tetramerous, persistent; æstivation imbricated; tube more or less curved; limb more or less 2-lipped. Stamens 4, didynamous, inserted on the tube of the corolla; anthers 2-celled, persistent, with the cells often cuspidato-calcarate at the base, dehiscing by a longitudinal slit or oblong pore. Ovary free, bound at the base by a fleshy disk, one-celled; placentæ parietal paired on each side the ovary, either distinct or geminately-connate, or with two broadly two-lobed placentæ extending from the parietes. Placents lateral as regards the axis of inflorescence. Ovules usually numerous, anatropous, with sometimes a longish funiculus; style terminal, simple; stigma large, capitato-two-lobed; lobes either over the placentæ, or placed anterior and posterior, sometimes obscurely sulcated in the middle, rarely sub-clavate, undivided. Capsule 1-celled, two valved at the apex or through its whole length; valves bearing on the middle or oftener towards the middle, solitary or paired, filiform or broad placentas. Seed numerous, rarely few, minute, globose, oblong, or pear-shaped; testa thick, spongy, scrobiculate or tubercled; albumen copious; embryo minute, obovoid.—Herbaceous, leafless plants, growing parasitically on the roots of other plants, often forming dense masses of great extent round the base of plants suited for their support; stems erect more or less covered with brown, yellowish, or colourless scales, in place of leaves.

Affinities. In my introductory remarks I have to some extent anticipated what I have to say here. Lindley maintains "that there can be little doubt that the nearest affinity of *Orobanchaceæ* is to *Gentianaceæ* with some of which, as for example *Voyria*, they correspond in their leafless habit and moreover in their corolla, adhering firmly to the base of the fruit, which it covers when ripe." These points of agreement however scarcely deserve the name of affinities they are rather analogies or resemblances. He continues "The great points of resemblance between *Orobanchaceæ* and *Gesneraceæ* and *Scrophularaceæ* consists in their monopetalous, didynamous flowers and bicarpillary, polyspermous fruit; and it is these that have led to the opinion that all the orders are closely allied. Such marks of agreement are doubtless important but they may be over balanced by others of greater importance. One of these is the position of the carpels with respect to the axis of inflorescence. In the whole category of plants, forming the Bignonal alliance, the carpels stand fore and aft with respect to the axis, while in Gentianworts we have as universally the two carpels placed laterally. In this striking character *Orobanche* agrees with the latter." Somewhat further on he states that he considers "that their capsule (of Orobanchaceæ) consists of two carpels standing right and left of the axis of inflorescence, and the margins not inflexed in the form of dissepiments, is incontestable," and that they bear the placentæ on their axis, that is, directly under or continuous with the lobes of the stigma, not, in the usual position, alternate with them.

Mr. Brown dissents from these views on the ground that the placentæ of *Orobanchaceæ* are double, and that he believes the carpels are anterior and posterior, not lateral, as stated by Lindley. As, however, his diction is not susceptible of abridgment, I must quote the whole paragraph though rather long. The previous remarks to which he alludes, as appertaining to the first family, refer to *Orchideæ*.

"With regard to the second family, in which Mr. Lindley believes the disk of the carpel to be ovuliferous, namely, *Orobancheæ*, I find no other argument advanced in support of this view than that derived from the bursting of the capsule into two lateral valves: but an opinion founded on dehiscence only, may be said to be a mere begging of the question; division through the axis of carpels, especially in the families related to *Orobancheæ*, being nearly as common as separation of their margins. In this family also, as in *Orchideæ*, the placentæ are double, an argument in favour of their sub-marginal origin: and although, whether the carpels be regarded as lateral, or anterior and posterior, the placentæ are not strictly marginal, yet there are other families where a similar position of placentæ is found, but in which the structure assumed in this hypothesis has never been suspected. As to the supposed affinity of *Orobancheæ* with *Gentianeæ*, which might be adduced in support of this view, as far as it is founded on the assumed agreement of the two orders in the lateral position of their carpels, the argument, even

if correct, would hardly be conclusive; for in *Gentianeæ* there is at least one genus having quadrifid and another with quinquefid flowers, in which the carpels are not lateral, but anterior and posterior, as I believe them to be in *Orobancheæ;* nor has it ever been supposed that in *Gentianeæ* the disk or axis is ovuliferous."

Between two such eminent philosophers I will not venture to hold the scales, but may perhaps be allowed to express my own impressions which are in favour of the latter view, a conclusion at which I had arrived before I clearly understood the drift of the arguments of either, on the faith of the appearances which I have endeavoured to get accurately delineated in the accompanying analyses, which I think are opposed to Lindley's views. But I must equally admit that one difficulty, and not a light one, stands in the way of its adoption; I allude to the fact of the placentæ being opposite or rather continuous in many, if not all Orobanchs, with the lobes of the stigma, whether these are anterior and posterior, or lateral. This statement I make principally on the faith of Reuter's generic characters, as I have not at present the means of verifying it, except in one or two instances.

Assuming this to be the case, is it susceptible of explanation in such a way as to preserve the analogy, so general throughout the vegetable kingdom, that the carpillary margins are the seats of the placentæ, and that the placentæ of a simple ovarium are necessarily double as being derived from the union of two carpillary margins whether in the axis or parietes of the cell.

I at once acknowledge my inability to adduce facts that carry full conviction to my own mind, but *Papaveraceæ* furnishes a case in point and by many *Cruciferæ* is believed to furnish another, where, it is presumed, the lobes of the stigma, which, as in *Orobanchaceæ* are continuous with the placentæ, are each made up of the union of a placentary vein from each of two carpels or in other words of two half lobes. If this is the case in that family, why not in *Orobanchaceæ?* I am aware that a very different explanation is given of the formation of the capsule of *Cruciferæ*, but still I doubt whether it is more satisfactory. And the venation of the corolla of the whole family of *Compositæ* may be adduced as furnishing an analogous example of parts being supplied with vessels from 2 sources, each segment of the corolla having two marginal veins but very rarely one in the axis. Assuming for an instant, that one of these corollas became converted into a 4- or 5-carpelled capsule, we should still have marginal placentæ, but with the lines of ovules continuous, not alternate, with the stigmatic lobes. This view, whether right or wrong, can claim in its favour the fact that many Orobanchs have the lobes of the stigma emarginate, as if made up of two sets of vessels, and derived from two carpels. Here I leave the question for the consideration of men more competent to the task and in possession of better materials for its investigation than I happen to have at my command.

Geographical Distribution. Europe, Africa, Asia and America, have all their species, but so far as I have been able to discover, none have yet been detected in Australia. In India they are not numerous but, it is my belief, when more carefully sought for and the species well distinguished, they will be found much more numerous than is now supposed. I have most frequently found them in alpine jungle, in localities exposed to the influence of the south-west monsoon rains, during which a very humid atmosphere prevails. The plant selected to illustrate the order is extensively distributed in Southern India, in those districts where Tobacco is largely cultivated, and is a most abundant and injurious weed. In Coimbatore it is in full perfection in March and April, when the Tobacco crops are approaching maturity. It is, I believe, the only true Indian Orobanche, all the other species, referable to the order, belonging to other genera.

Properties and Uses. Astringency and bitterness are the predominating qualities of this order. But little seems to be known regarding them or, perhaps, I should rather say, that their properties are of so weak or indeterminate a kind, as not to merit much notice. Of those of the Indian species, I can find no account beyond the remark, in Lindley's Vegetable Kingdom, that "*Æginetia indica*, prepared with sugar and nutmeg, is considered an antiscorbutic.

Remarks on Genera and Species. Under this head I must again have recourse to the remarks on the order (in my Icones), from which I have already quoted, which were written

for the purpose of explaining the principles, on which I was induced to construct some new genera, and recast the arrangement of the rest, and which, if carried out, may lead to a better understanding of this difficult family. Referring to that extract and the character of the order for its leading characteristics, the following distribution into sections will be easily understood, as well as the use of these in facilitating the limitation and discrimination of the genera by easily recognised marks. Still further to place this arrangement in a clear light, I have devoted a plate to its illustration, in which I have given more or less perfect analyses of 14 genera and 15 species. In the explanation of that plate, I have not deemed it necessary to do more than give a list of the names of the species introduced, the parts represented being throughout so obvious as not to require separate enumeration.

Before concluding these remarks I may as well mention in regard to the analysis, *O. Nicotianæ* (Plate No. 158), that all the coloured figures were taken from recent specimens. The uncoloured highly magnified sections of the ovary and fruit from dried ones, but which had not been pressed in drying so as to change the form of the parts. The whole plant having been soaked to restore pliability, the flowers wanted for examination were then picked off. The condensation of the spongy matter of the placentæ by drying, shows I think more clearly their mode of formation, and seems to me to go far in support of my theory of occasional plurality of carpels in this order, but on that point I leave the figures, the correctness of outline of which I can attest, to speak for themselves.

"Availing myself of these variations of structure and placentation of the ovary, I propose grouping the order, so far as it is known to me, under the following sub-orders or sections.

I. Orobancheæ. Ovary of several (?) carpels, 1-celled: placentæ parietal. *Orobanche, Cistanche, Conopholis, Anoplanthus.*

II. Æginetieæ. Ovary of 2 carpels, 1-celled: placentæ parietal, large, fleshy, lamellate or solid. *Æginetia, Oligopholis.*

III. Lathrææ. Ovary of 2 carpels, 1-celled; carpels partially cohering in the parietes, the placentiferous margins remaining free and spreading to the right and left, forming two broad lamellar placentæ. *Phelipæa, Lathræa, Epiphagus.*

IV. Hyobancheæ. Ovary imperfectly 2-celled, that is, the inflexed carpels only partially meet in the axis, but the placentiferous margins, remaining free and being reflexed, form 2 loose placentæ in each cell. *Hyobanche, Campbellia, Christisonia, Harveya,? Aulaya?*

The last two genera are doubtfully added to this list, Mr. Bentham having already referred them to *Scrophulariaceæ*, but as the habit and, apparently, the seed are not in unison with the rest of that family their admission into this list may lead to further, and perhaps more accurate scrutiny so as to leave no future doubt of their proper location. If really Orobanchs, they, especially the last, form, through *Striga*, the transition to *Scrophulariaceæ;* but judging from Sir W. Hooker's analysis of the two genera, the former only, which has two placentæ in each cell, is truly referable to this order, while *Aulaya* passes into the other.

The first section, constituting, I presume, the type of the order, unless I have misunderstood its structure, differs widely from the rest in having several carpels, all the others having only two. I am aware that this view is at variance with the received opinions of Botanists, and therefore forbear to urge it beyond calling attention to what, to me, appears to be the true structure of the genera I have referred to it, and which, if confirmed by more extended examination, will perhaps lead to its segregation as a distinct order. The second and third of my sections respectively represent in this group *Bignoniaceæ* and *Gesnereaceæ.* The fourth approaches *Scrophulariaceæ*, from which it is kept distinct by its imperfectly 2-celled ovaries and by the placentiferous margins of each carpel remaining distinct, in place of coalescing with its fellow into a single axile placenta. Should further observation prove these sections, which I find of easy application, well founded, generic distinctions will henceforth be more readily obtained; the uniformity of external characters, in the absence of sub-division, causing a deficiency of good distinctive marks by which to define the limits of genera.

The following synopsis of the genera known to me, either from examination of specimens or good figures, may serve to explain my meaning.

I. Orobancheæ.

1. Orobanche. Calyx wanting or rudimentary, bracteoles dilated at the base, calyciform. Corolla tubular, bilabiate, lips ⅔ lobed. Anthers glabrous, placentæ 4–6, parietal.

2. Cystanche. Calyx bracteolate, tubular, 5-cleft. Corolla tubular sub-equally 5-lobed. Anthers woolly, placentæ 4, parietal.

3. Conopholis. Calyx bracteolate, sub-spathaceous. Corolla ringent, upper lip large, vaulted, under short, 3-lobed. Anthers pubescent. Placentæ 4, parietal.

4. Anoplanthus. Calyx ebracteolate, 5-cleft. Corolla tubular, arched or bent at the base, equally 5-toothed, or sub-bilabiate. Anthers glabrous. Placentæ 4, parietal.

II. Æginetieæ.

5. Æginetia. Calyx and bracts wanting, their place supplied by a loose spath. Corolla tubular, 5-lobed. Anther cells divaricate, both fertile. Placentæ lamellate.

6. Oligopholis. Calyx tubular, 5-toothed. Corolla tubular, 5-lobed. Anthers 2-celled, one sterile, subulate. Placentæ 2, fleshy, not lamellate.

III. Lathrææ.

7. Lathræa. Calyx ebracteolate, 4-cleft. Corolla ringent, upper lip entire, under smaller, 3-lobed.

8. Phelipæa. Calyx bracteolate, tubular, 4–5-thoothed. Corolla ringent, upper lip 2- under 3-lobed, spreading.

9. Epiphegus. Flowers polygamous. Calyx bracteolate, urceolate, 5-toothed. Corolla bilabiate, upper lip entire, under 3-lobed.

IV. Hyobancheæ.

10. Hyobanche. Calyx bracteolate, deeply 5-cleft Corolla ringent, upper lip long, entire, under small, obscurely 3-toothed. Anthers deflex, pendulous, 1-celled!

11. Campbellia. Calyx bracteolate, tubular, 5-toothed. Corolla sub-bilabiate, 5-lobed. Anthers deflex, pendulous, one-celled! opening by a pore at the apex.

12. Christisonia. Calyx tubular, 5-toothed. Corolla infundibuliform, sub-bilabiate. Anthers 2-celled, one sterile, subulate. Placentæ free, revolute.

13. Harveya. Calyx inflato-campanulate, 5-lobed. Corolla tubular, sub-bilabiate, 5-lobed. Anthers 2-celled one sterile, subulate. Ovary 2-celled, with 2 fleshy placentæ in each.

14. Aulaya. Calyx tubular, 5-cleft. Corolla tubular, 5-lobed. Anthers 2-celled, one sterile, subulate. Ovary 2-celled, with a single, axillary placenta in each. [Obs. Mr. Bentham remarks of this genus, "placentæ in diversis speciebus magis minusve bilobæ," which seems to indicate that it is correctly referable to this order."]

EXPLANATION OF PLATE 158.

Orobanche Nicotianæ, natural size.

1. 2. Front and side views of full-blown flower.
3. Corolla split open, stamens in situ.
4. Front and back views of anthers.
5. Ovary, bract, and calycine bracteoles.
6. Ovary cut transversely, 4 placentæ.
7. Another ovary with 8 placentæ.
8. A young fruit, the top of the capsule removed to show the placentæ non-adherent at the apex.
9. Capsule enclosed in the persistent corolla.
10. The same, corolla removed.
11. Same cut longitudinally.
12. Capsule in a state of dehiscence.
13. A detached seed. 14. Embryo.
15. A six-placentæd capsule dehiscing.
16. A four-placentæd capsule cut transversely.
17. One with 5 placentas.
18. One with 6 placentas similarly divided. The last five figures taken from dried specimens.

EXPLANATION OF PLATE 158–b.

I. Orobancheæ.

1. Orobanche Epithymum (DC. Nees' Germ. Gen.).
2. Conopholis Americanus (Wallr. Endl. Icon.).
3. Anoplanthus (E) uniflorus (Endl. Iconograph.)
4. Cystanche lutea (R. W. Icones).

II. Ægineticæ.

5. Æginetia Indica (Roxb. R. W. Icon.).
6. ——— pedunculata (Wall. R. W. Icon.).
7. Oligopholis tubulosa (R. W. Icones).

III. Lathræeæ.

8. Epiphegus Americanus (Nutt. Endl. Ic.).
9. Phelipæa ramosa (Desf. Nees' Germ. Gen.).
10. Lathræa spuamaria (Lin. Nees' Germ. Gen.).

IV. Hybончeæ.

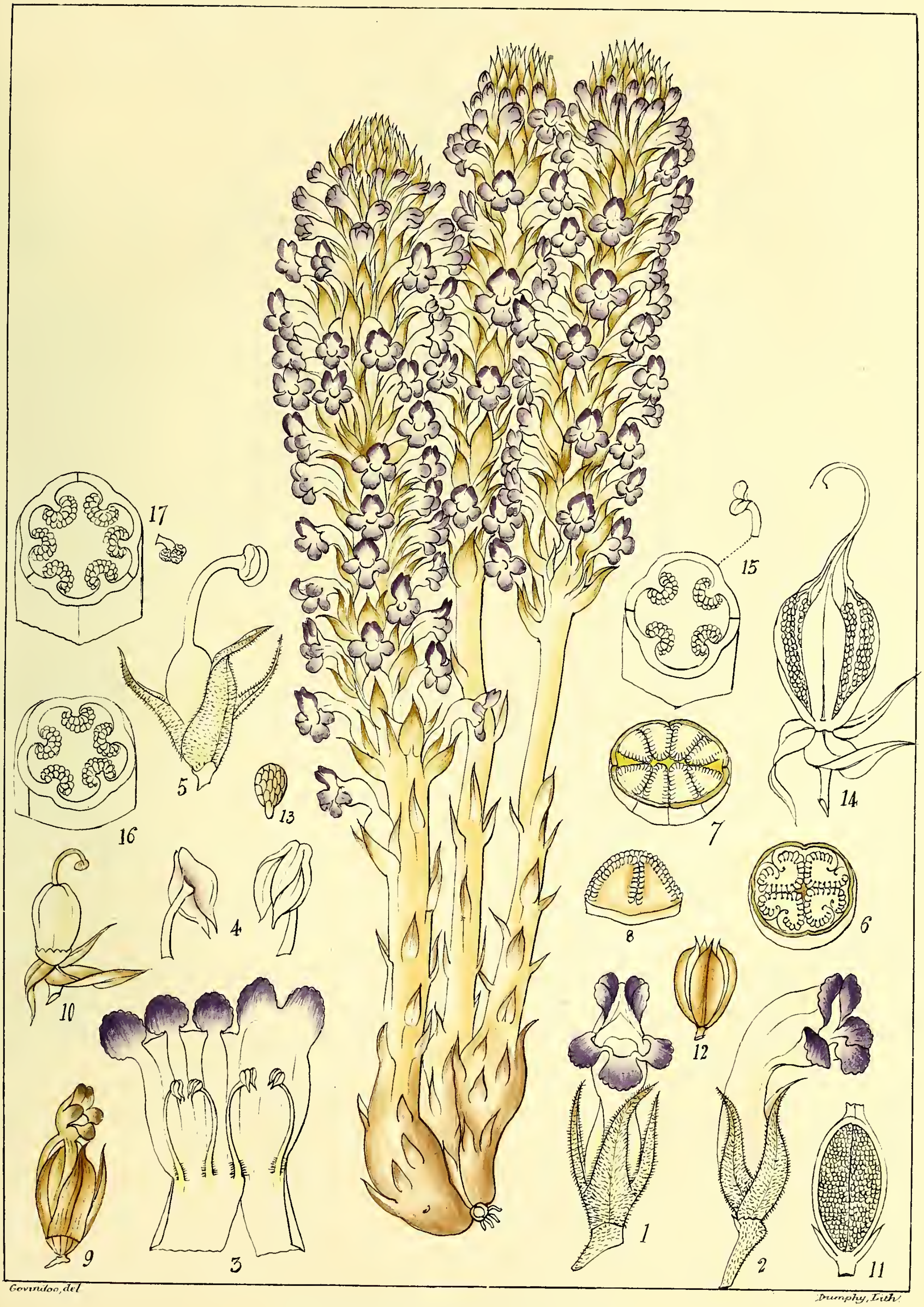
11. Hybonche sanguinea (Thunb. Endl. Icon.).
12. Aulaya squamosa (Harv. Hook. Icon.).
13. Harveya Capensis (Hooker Icones).
14. Campbellia aurantiaca (R. W. Icones).
15. Christisonia calcarata (R. W. Icones).

Two sections of the ovary (1 and 2) are given in 14 and 15. The first (1) is taken near the apex, the other (2) below the middle of the ovary, a third near the base, would probably have shown the placentæ united, as in Aulaya.

CX.—GESNERACEÆ.

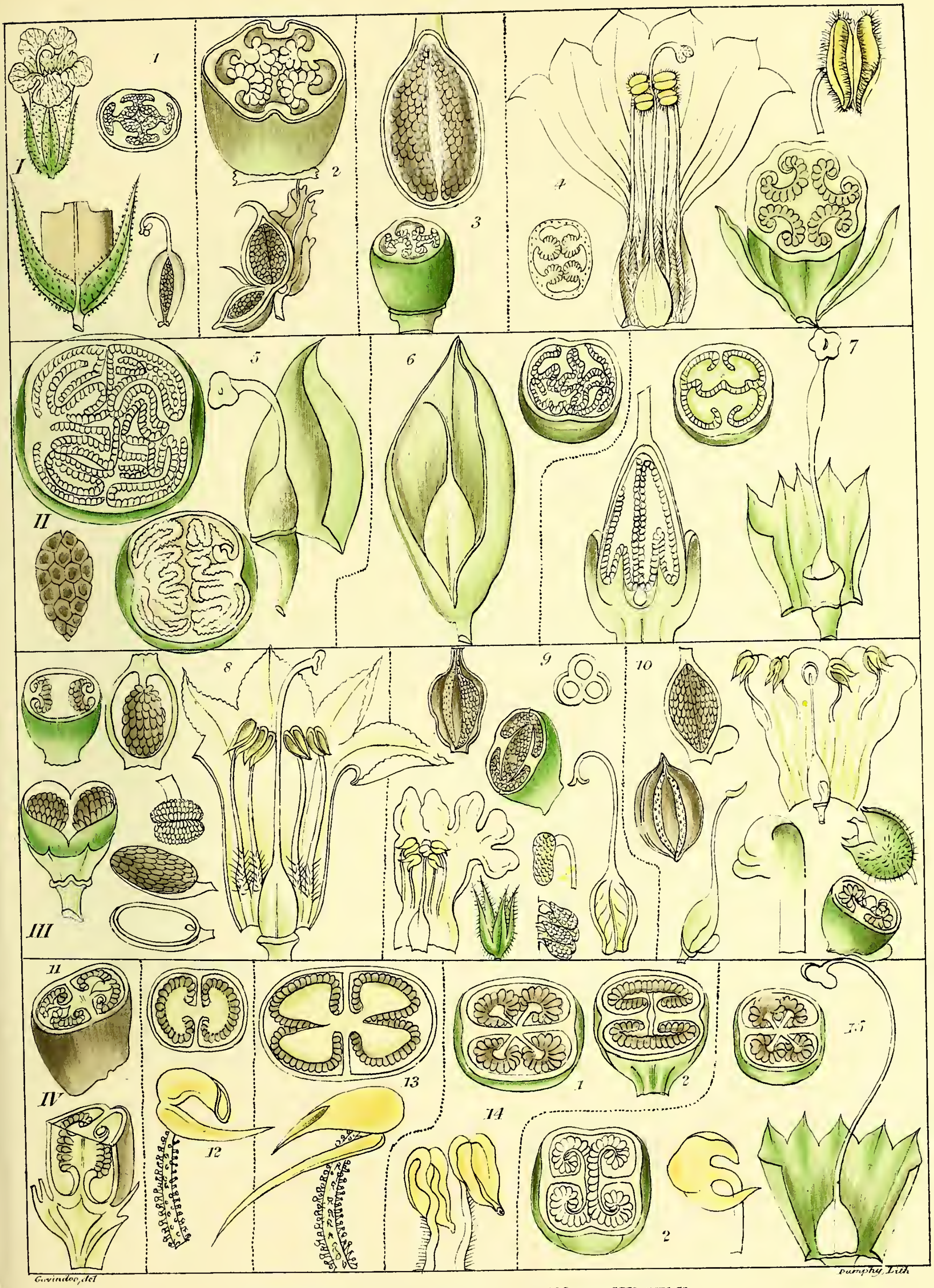
This order was first established in 1804 by Richard and Jussieu, and was then limited to plants having the calyx, more or less adherent to the ovary and albuminous seed. Subsequently, in 1823, Jack defined, under the name of *Cyrtandraceæ*, what he considered a new order, founded on a number of Malayan plants differing from the preceding, in having the ovary quite free, and exalbuminous seed. These two orders were long kept distinct, and are separately taken up by De Candolle in his Prodromus with 26 orders interposed. Recent examination and better acquaintance with their respective peculiarities have led to their union and sub-division into two, well marked sub-orders, under the names of *Gesnereæ* and *Cyrtandreæ*, differing only in the above essential points of structure. The former of these sub-orders is almost exclusively confined to America, one genus only, *Klugia*, having Asiatic representatives ; the latter has a wider distribution, but is principally of Asiatic origin.

This family, as being made up partly of plants with, and partly without albuminous seed, affords another example of the fact, that the presence or absence of that organization is not always of even ordinal value, and is of course still less applicable to the formation of groups of a higher denomination, when opposed to others taken from general structure and vegetation. The adherent ovary of *Gesnereæ*, and the free one of *Cyrtandreæ*, may also, I think, be adduced



Govindoo, del. Dumphy, Lith.

OROBANCHE NICOTIANEÆ (R.W.)



Govindoo, del | Dunphy, Lith

I. OROBANCHEÆ. II. ÆGINETIEÆ. III. LATHRÆEÆ.

IV. HYOBANCHEÆ.

as bearing on the question mooted under *Vacciniaceæ* and *Ericaceæ*, the two divisions of this order, bearing precisely the same relations to each other that these two orders do, hence, if union is right in the one case, separation can scarcely be so in the other. Mr. Brown thus defines the conjoint order in Horsefield's Plantæ Javan. rariores.

Character of the Order. Calyx 5-cleft, equal (rarely a little unequal). Corolla monopetalous, irregular, limb 5-lobed, imbricating in æstivation. Stamens 2–4, antheriferous with or without a fifth posticous rudimentary one. Ovary (free or aduate) 1-celled; (occasionally, by the approximation of the placentæ, apparently 2-celled); bound at the base by a lobed or entire disk; placentæ two, parietal, lateral (usually bilamellate), many-seeded; ovules anatropous. Pericarp capsular or baccate. Seed small (no raphe), albuminous or exalbuminous; albumen fleshy, soft, copious or sparing. Embryo straight, axile, orthotropous, when present about half the length or as long as the albumen.—Herbs or undershrubs with simple, undivided, exstipulate, opposite, verticelled or alternate leaves, often serrated or crenate, sometimes quite entire, for the most part clothed with simple, acute or capitate pubescence. Inflorescence various.

He divides the order into the three following sections.

Gesnerieæ. Calyx more or less connate with the ovary. Pericarp capsular. Seed with copious albumen.

Beslerieæ. Calyx free. Pericarp baccate or capsular. Seed albuminous.

Cyrtandreæ. Calyx free. Pericarp capsular or baccate. Seed exalbuminous or sparingly albuminous.

Affinities. A glance at the component parts of this order will show that its affinities must naturally be complex. The adherent calyx and copious albumen of the first tribe, brings it in contact with some of the monopetalous calyciflorous orders, among which it is placed by De Candolle, but from which it is far removed by its irregular didynamous flowers, 1-celled ovary, and inflexed carpillary margins. These again with its albuminous seed bring it in contact with *Gentianeæ* on the one side, and its irregular flowers with *Orobanchaceæ* on the other. The free calyx and albuminous seed of the second, combined with its irregular flowers, brings it into immediate contact with *Orobanchaceæ*, from which it is principally separated by habit: while the third, having a free calyx and exalbuminous seed, passes almost directly into *Bignoniaceæ*, through *Eccremocarpus* and *Æschynanthus*.

Thus complex in its structure and organization, it seems most correctly placed here, as forming in itself the connecting link between the albuminous and exalbuminous division of the Bignonal group, to each of which it seems so nearly related, as to be principally kept distinct by habit, and, in the exalbuminous division, by the small size of its seed and short cotyledons as compared with the radicle. Their relationship to the calyciflorous orders, I look upon as of secondary moment, agreeing as they do in one point only, the partially adherent calyx, which I look upon as of no note, when set against the widely different floral structure and fructification.

Geographical Distribution. The two first of the above tribes are, as already mentioned, almost entirely confined to the tropical and warmer parts of America. The third is more widely diffused. Two are found in Europe, one in Siberia, one in Australia, and a few in Africa; but the mass of the tribe are natives of India and the Eastern Islands. In Assam and Khassya, they are numerous, and from the last named district the one selected for representation was obtained and communicated by the late Mr. Griffith.

Properties and Uses. On this subject little can be said. Many of the Indian species are plants of great beauty and deserving of a place in gardens as being very ornamental, a distinction however rarely accorded, possibly owing to the difficulty of cultivating in gardens, plants which, in their native stations, seek shade and moisture of both air and soil. None of them, so far as I am aware, have been applied to any useful purpose.

Remarks on Genera and Species. My examination of species of this order, has been on too limited a scale to admit of my having much to say under this head. A few new species and one new genus have been added to the family, accompanied with figures, in my Icones. The new genus is interesting in connexion with the affinities of the order, the ovary bearing the same relation to the other genera that the Tribe *Orobancheæ* does to the other tribes of that order. That is, it has four parietal placentary lines, as in *Cystanche*, while all the others have inflexed placentæ. With a view to making some of the genera of this order better known, as well as for the purpose of showing the relationship existing between this and the two preceding orders, I shall, in a supplementary plate, give analyses of some of the genera, partly taken from my own dissections, partly copied from those of others. It may be proper here to remark that the difference between *Chirita* and *Didymocarpus*, is very slight, so slight indeed that it is most difficult to distinguish them, resting as it does entirely on the stigma. For some time I felt doubtful whether I ought to place the following species in the one or other genus, but think that it accords better with the latter, to which therefore I refer it. In the supplementary plate I have given analytical illustrations of 12 genera, which I shall simply name; the explanation of one in a great measure serving for all.

EXPLANATION OF PLATE 159.

Didymocarpus Griffithii (R. W.), herbaceous, erect, 4-sided, furrowed on the sides; angles roundish blunt, pilose above: leaves ovate, acuminate, crenato-serrated, longish petioled, pilose on both sides: peduncles axillary, longer than the petiols, cymosely 5–7-flowered; flowers longish pedicelled: calyx deeply 5-parted, segments lanceolate: corolla tubular, five-lobed: stamens didynamous, the fifth rudimentary one sometimes wanting, stigma two-lobed. Leaves, including the petiol, 4 to 6 inches long by $1\frac{1}{2}$ broad at the base; cymes furnished with a pair of lanceolate bracts at each division: tube of the corolla, hairy without. Khassya, Griffith. This appears a very handsome species and quite new.

1. Flowering branch, natural size.
2. Detached flower.
3. Corolla split open.
4. Anthers.
5. Ovary and calyx about natural size.
6. Ovary magnified.
7. Cut longitudinally.
8. Transversely.
9. Young capsule.
10. Transverse section of capsule.
11. Portion of one valve after dehiscence.
12. Seed.
13. Cut transversely.
14. Embryo detached.
15. Upper and under surfaces of leaves.

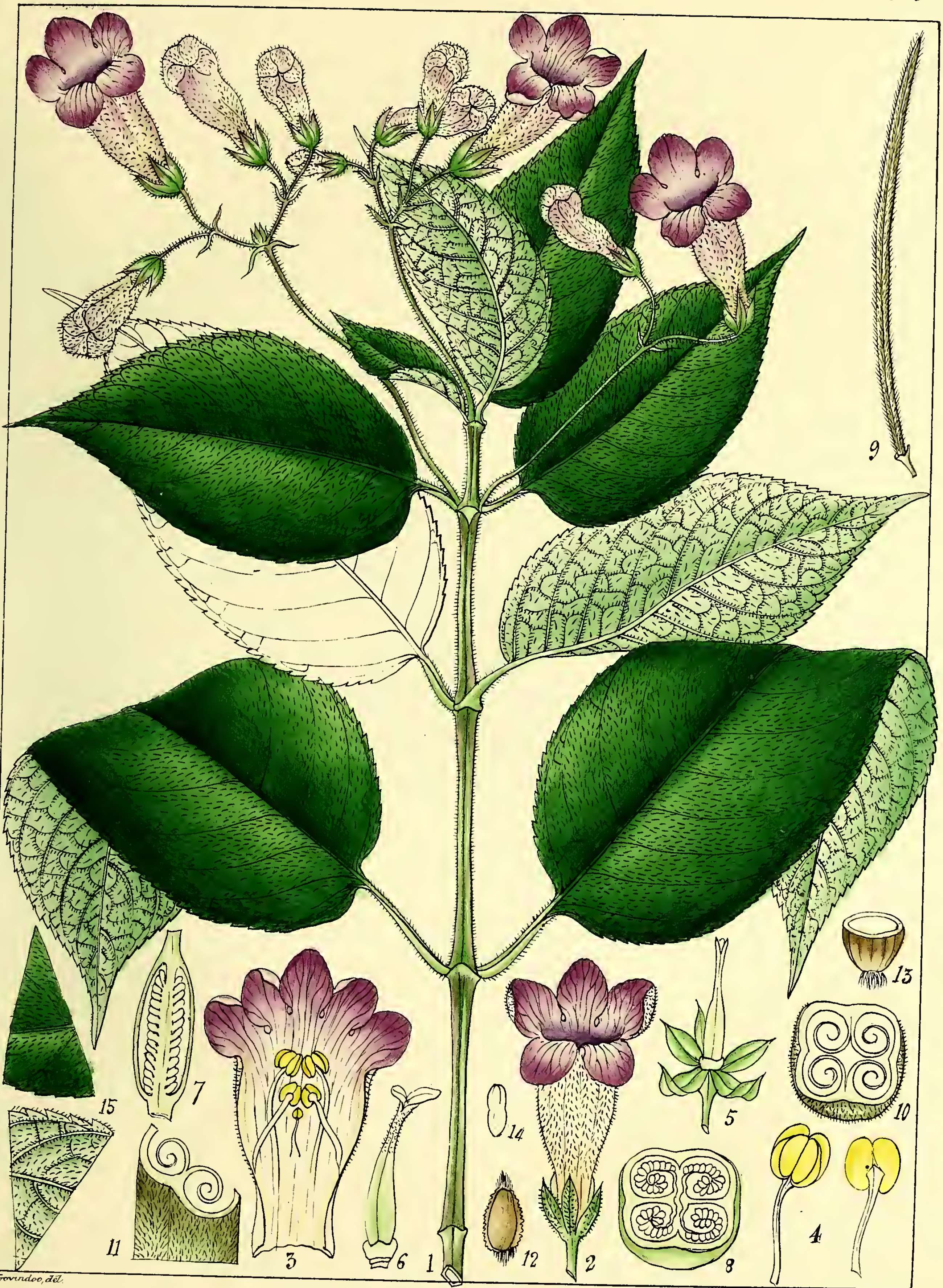
EXPLANATION OF PLATE 159–b.

1. Didymocarpus tomentosa (R. W. Ic.).
2. Jerdonia Indica (R. W. Icon.).
3. Epithema Ceylanica (Gard. R. W. Ic.).
4. Klugia Notonian (DC. R. W. Ic.).
5. Isanthera permolis (Nees. R. W. Ic.).
6. Loxonia acuminata (R. Br. Pl. Jar. Rar.).
7. Rhynoglossum obliquum (DC. Loxolis R. Br. l. c.).
8. Bæa hygrometrica (R. Br. DC. Deless. Ic.).
9. Lysionotus tenufolia (Wall. pl. as. rar.).
10. Platystemma violoides (Wall. pl. as. rar.).
11. Æschynanthus ramosessima (Wall. pl. as. rar.).
12. Streptocarpus Rexii (Lind. Hooker Exot. Flora).

CXI.—BIGNONIACEÆ.

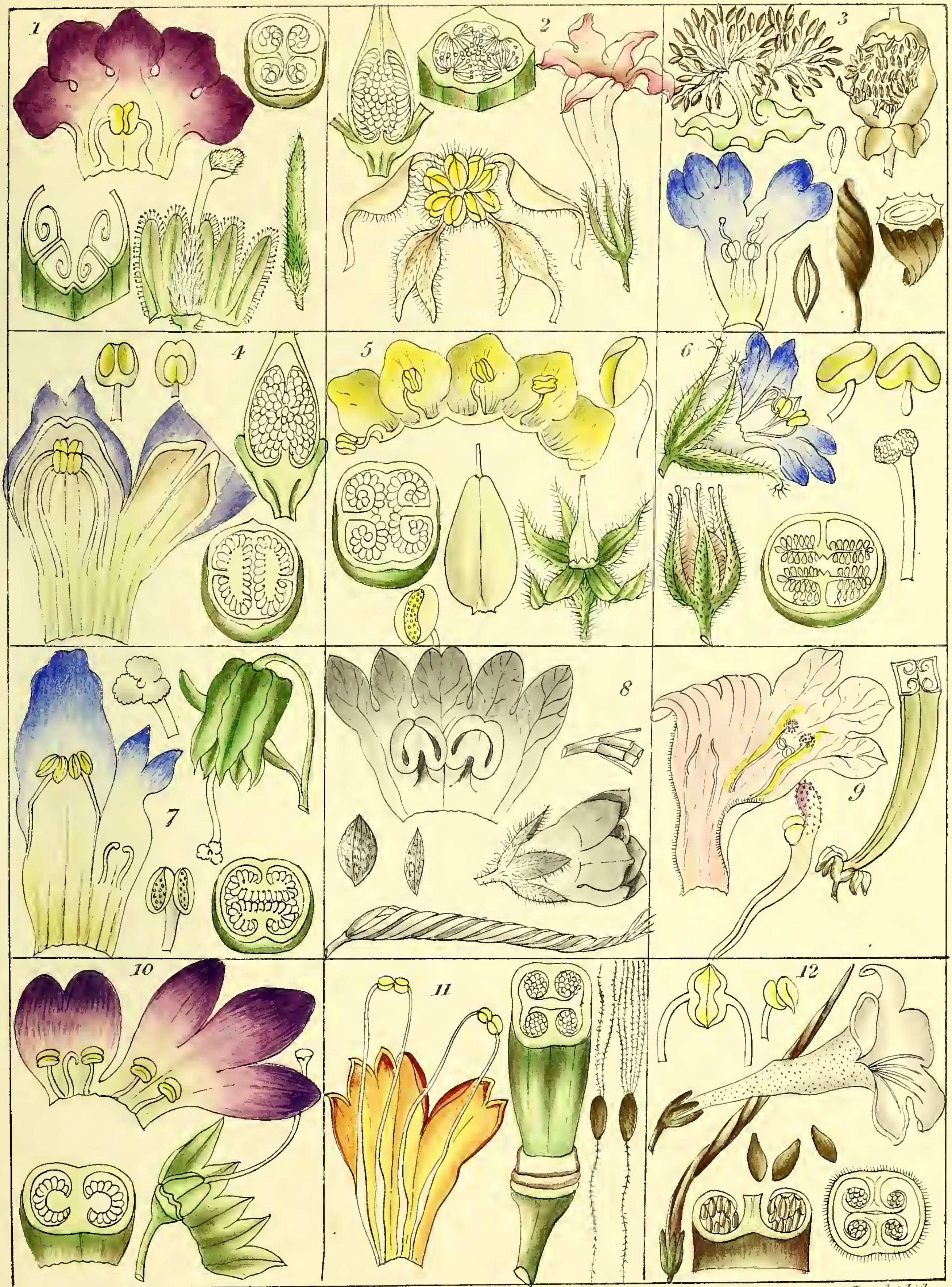
This large and handsome arborious order, being for the most part composed of tropical plants, or at all events exotics to Europe, was long very imperfectly known, so much so indeed, that of this and the immediately allied orders, *Sesameæ* and *Gesneriaceæ*, Linnæus scarcely knew above 20 or 25 species; whereas above 730 are now described in botanical works. Of true *Bignoniaceæ*, or those furnished with dehiscent capsules and winged seed, Linnæus only knew 18 species; and now the list extends to no fewer than 450.

With regard to the limits of the order some differences of opinion exist, but I believe Botanists are now pretty generally agreed in confining it to such plants as have monopetalous personate flowers, the capsule splitting into two halves, and flattened winged seed. The structure of the ovary seems variable as in different species and genera it is described as being 1-or 2-celled. In the accompanying analysis of the ovary of several species it will be seen that that organ is usually formed in the regular way, that is, the carpellary margins bear the placentæ on each side, but that here they are generally joined across the centre by means



Govindoo, del. Dunphy, Lith.

DIDYMOCARPUS GRIFFITHII



Govindoo, del. Dumphy, Lith.

1. DIDYMOCARPUS. 2. JERDONIA. 3. EPITHEMA. 4. KLUGIA. 5. ISANTHERA.
6. LOXONIA. 7. LOXOTIS. 8. BÆA. 9. LYSINOTUS. 10. PLAYTYSTEMMA. 11. ÆSCHYNANTHUS.
12. STREPTOCARPUS.

of a spurious partition, or membranous extension or band, which afterwards thickens, becoming, in the accompanying species, firm, coriaceous and straplike, but in others round, thick and spongy, bearing on its sides the seed. Some however are truly two-celled.

Character of the Order. Calyx lobed or entire, sometimes spathaceous. Corolla monopetalous, hypogynous, deciduous, irregular, 4–5-lobed or sub-bilabiate, lobes imbricating in æstivation. Stamens usually 4, fertile, didynamous, with a sterile filament, sometimes all fertile; anthers 2-celled, cells parallel and contiguous or separate and diverging, opening longitudinally. Disk glandulose, tumid, embracing the base of the ovary. Ovary 2- rarely 1-celled, ovules several or numerous, attached to lateral placentæ usually united in the axis by a short process which, with the thickened placentæ, afterwards becomes the spongy partition. Style filiform, stigma bilamellate or bifid, lamellæ anticous and posticous. Capsule 2-valved, 2-celled, often long, compressed, sometimes spuriously 4-celled, the septum either parallel to the valves, or contrary to them, finally separating and bearing the seeds. Seeds transverse, compressed, winged, exalbuminous; embryo straight next the hilum, cotyledons flat, foliaceous or fleshy.—Trees or shurbs, stems erect, scandent, or twining. Leaves opposite, sometimes simple, usually compound, the petiol sometimes produced into a tendril. Stipules none, but sometimes replaced by accessory leaflets. Inflorescence usually panicled or racemose.

Affinities. As regards the flowers this order is nearly allied to *Pedaliaceæ*, *Gesneriaceæ*, *Acanthaceæ*, and *Scrophulariaceæ*, but is kept distinct from all by its winged seed, provided the section *Crescentieæ*, which De Candolle retains, is separated to form a new order, a view in which Botanists now generally coincide, as its retention may be said to break down the essential character of the order. Much stress is laid on the axile position of the placentæ, which Lindley observes "is an indispensable character of this natural order," but immediately goes on to observe that "the genus *Eccremocarpus*, however, appears to be an exception, its placentæ being strictly parietal at the time of the expansion of the flower" and, further, that he long since stated that the placentation of *Bignonia radicans* is originally of the same nature, the difference between them consisting in the 2 placentæ of the latter meeting in the axis and uniting there, while those of *Eccremocarpus* never touch in the middle. The same seems to be the case in the species here figured *(Spathodea adenophylla)*, and doubtless will be found in many others, when all have been examined at a sufficiently early stage. I have remarked a similar structure in several species of *Acanthaceæ*, the inflexed valves of which do not quite meet until after the fall of the flower, though they also are said to have axile placentation. But indeed the difference between the fruit of *Bignoniaceæ* and *Acanthaceæ*, at least as I understand them, is not so great as, at first sight, one might be led to suppose, and neither have, strictly speaking, axile placentæ, such as in *Scrophulariaceæ*. The structure of the ovary in both families is nearly the same, and both have bivalved, 2-celled, dehiscent capsules. The essential difference, therefore, exclusive of habit, is found in the spurious partition of *Bignoniaceæ*, and in the mode of dehiscence of the capsule in the two families. In the former (Bignoniaceæ) it is either septicidal or loculicidal but without elasticity; in the latter it is always loculicidal. In other words, in the tribe *Eubignoniaceæ* the dehiscence takes place in the line of the placentæ, equivalent to septicidal; the spurious partition, on the sides of which the seeds lie, at the same time separating from the valves, is found loose within the capsule: the septum is then said to be parallel to the valves. In the sub-tribe *Catalpeæ* it takes place along the middle or dorsum of the carpels, that is, loculicidally; the partition is then said to be contrary or with its edges opposite the middle of the valves, which valves, in this case, are each made up of two half carpels cohering along their placentary margins. This is precisely what takes place in *Acanthaceæ*, with this difference, that in Acanthaceæ there is no free, spurious partition, but the seed are attached to persistent placentary processes, and the valves usually separate with elasticity. The affinity, therefore, between *Acanthaceæ* and the sub-tribe *Catalpeæ* is very close. The affinity between *Bignoniaceæ* and *Scrophulariaceæ*, which Lindley also places in his Bignonal Alliance, is not so close, for though they associate as well as regards the flower, the placentation differs in being decidedly axile and the seed albuminous, neither of which is truly the case in Bignoniaceæ or Acanthaceæ.

Geographical Distribution. The tropics and the warmer regions, on either side of America, are assuredly the head-quarters of this splendid order, whose magnificent flowers are the glory of the places they inhabit. In India they are comparatively rare, about 30 Indian species only having as yet found their way into botanical works. That there are more I have not a doubt, but the great size of suitable specimens, and the difficulty of preserving them, stand in the way of many species finding a place in herbaria. This circumstance more than any other prevents our acquiring a perfect knowledge of them. The fruit of nearly all are most unmanageable in herbaria from their great length, and they are almost indispensable towards the determination of the genera.

Properties and Uses. On this head, so far as the Indian species are concerned, almost nothing seems to be known. The roots of *Stereospermum* (Bignonia) *chelonoides*, are said to be pleasant tasted and are, with the fragrant flowers, prescribed in infusion as a cooling drink in fevers. Rheede states that in Malabar, the juice of the leaves, mixed with lime juice, is administered in maniacal cases. As an ornamental object, the *Millingtonia hortenses* is not unfrequent in gardens, and the species of *Stereospermum* (Padree poo) are prized on account of the delightful fragrance of their flowers. Probably more of them would be met with in cultivation, were their flowers more permanent, but unfortunately they are all very deciduous, opening during the evening and dropping from the tree early next day. Those of several are picked up by the natives and, made into garlands, presented at the shrines of their idols.

Remarks on Genera and Species. De Candolle divides this family into two tribes, *Bignonieæ* and *Crescentieæ*. Of the latter the Indian Flora furnishes no representatives; of the former, 9 out of 42 genera are noted as having Indian species. Roxburgh describes 12 species under the single generic name *Bignonia:* these are now distributed under seven genera. This may perhaps be accounted for by the loose construction of the Roxburgian generic character, which is more applicable to an order than a genus. The *Bignonieæ* are again divided into two sub-tribes, *Eubignonieæ* and *Catalpeæ*, distinguished by the position of the partition of the capsule. In the former, the partition is parallel to the valves, in the latter it is opposite to them or contrary, as explained above. This is an excellent character, so far as it goes, but as being only applicable to specimens provided with fruit far advanced towards maturity, it is in every way desirable to endeavour to find generic characters which can be depended upon for their discrimination at earlier stages of their existence, in place of having to depend so much on those derived from a part of the plant which, owing to the great size and length it often attains, is comparatively rare in herbaria. The fact, however, of Roxburgh having grouped under one genus species which are now considered referable to seven genera, shows that the task is not an easy one, as indicating the strong family likeness that prevails throughout the order. The genera, however, as now constituted, do not seem difficult of discrimination with good specimens to work upon. The genus, *Heterophragma*, DC., founded on Roxburgh's *Bignonia quadrilocularis*, seems one of the most remarkable of the order, but is very imperfectly known, Roxburgh having neglected to represent sections of the ovary in his plate, and passed over, in his description, both it and the mode of dehiscence of the capsule, so that it is now impossible to say to which sub-tribe it belongs. De Candolle somewhat doubtfully places it in his second sub-tribe *(Catalpeæ)*, but to me it appears more justly referable to the other, and seems nearly allied to *Astianthus*, a Mexican genus, having, like it, a thick septum. In *Heterophragma*, the septum is thicker in the middle, reaching to each side of the capsule, but the insertion of the seed seems to be marginal, similar to those of *Calosanthes*, an Indian genus nearly allied to *Astianthus*. This is of course conjecture, but which seems strengthened by Roxburgh's figure which corresponds pretty well with that of *Calosanthes*. The plant I have selected to illustrate the order *(Spathodea adenophylla)*, differs somewhat from the character of the genus in the form of the calyx, and the septum of the capsule is coriaceous, not spongy, the more usual form. In the additional plate (No. 161–b. fig. 2) two sections of the ovary of *Calosanthes* are given, one from a young flower-bud, some time before expansion, the other from a young fruit some days after the fall of the flower. They were both taken from the same specimen and will serve to show, to some extent, the changes which the fruit undergoes in its progress towards maturity. That plate was prepared for the

Govindoo, del. Dunphy, lith.

SPATHODIA ADENOPHYLLA (WALL. ALPH. D.C.)

Govindoo del. Dumphy Lith

I. BIGNONIA. II. CALOSANTHES. III. SPATHODEA. IV. STEROSPERMUM
V. BIGNONIA? VI. MILLINGTONIA. VII-VIII. TECOMA. IX. PANJANELIA.

purpose, of showing in several species the origin of what I have called the spurious partition. The formation of a true partition or septum is shown in the lower fig. of No. 3, and in No. 4. In these examples the inflexed margins of the carpels actually meet in the centre and coalesce, forming a single placenta in the axis. In all the others the placentæ are parietal with a process stretching from the one to the other, which, as shown in the upper figure of No. 2, enlarges with the fruit and becomes the septum. But the placentæ do not enlarge in the same way, they continue parietal throughout, hence the seed in the nearly mature capsule are always found attached to the sides of the capsule along the edge of the partition and covering it with their broad wings. Such being the position of parts it results, that it is an error to describe the position of the placentæ as axile, and to assume that "the central or axile position of the placenta is an indispensable character of this natural order." It equally follows that *Eccremocarpus* is only exceptional to the extent of wanting the spurious partition, shown to exist in nearly all the others, not in regard to its parietal placentation.

EXPLANATION OF PLATE 160–61.

Spathodea adenophylla (Wall. Alph. DC.).

1. 2. Flowering branch and ripe capsule.
3. Flower-bud.
4. Corolla split open.
5. Stamens, back and front views.
6. Calyx and ovary.
7. Ovary cut transversely.
8. Longitudinally.
9. An ovary a little further advanced, divided in the line of future dehiscence, and opened to show more clearly the parietal placentation.
10. A portion of 2 placentas detached from the capsule.
11. A detached seed.
12. Same, testa removed, cotyledons in situ.
13. A cotyledon and plumule seen from within.
14. Section of a mature capsule after dehiscence had commenced.

EXPLANATION OF PLATE 161–b.

1. Bignonia xylocarpa (Roxb.).
2. Calosanthes Indica (Blume, DC.).
3. Spathodea, species undermentioned.
4. Sterospermum Checonoides (DC.).
5. Bignonia amæna (Wall. an Spathodæa ? DC.).
6. Millingtonia hortenses (Linn. pl.)
7. Tecoma capensis (Lind.).
8. Tecoma Jasminoides (Lind.).
9. Pajanelia Rheedii (R. W.).

Sub-order Schrebereæ. R. W.

Under *Jasmineæ* I alluded to the genus *Schrebera*, referred by Alph. De Candolle and Fenzl to that order on the faith of Roxburgh's incorrect figure and imperfect description, but whose affinity with it I doubted. It had hitherto been placed in *Bignoniaceæ.* While writing the article Bignoniaceæ, I rëexamined the plant with more attention and had a drawing, and as careful an analysis as my rather imperfect materials enabled me to make, prepared. This examination has tended to confirm my former conjectures as to its being distinct from *Jasmineæ*, and Bignonal in its characters, but distinguished from all the genuine members of that group by its regular corolla and diandrous flowers. In these respects it approaches some *Acanthaceæ* as well as in its 2-valved, 2-celled capsules, the dehiscence of which is in accordance with those of that family, that is, loculicidal with contrary partitions. It however differs in its arborious habit, compound leaves, winged, pendulous seed, and plicate or sub-chrysoloid, fleshy cotyledons. Towards *Pedaliaceæ* it stands in nearly the same relationship as towards *Acanthaceæ*, but does not enter that order; neither will it enter *Bignoniaceæ*, though approaching it in so many points as to have led to its being hitherto placed in that order, and, to my mind, more naturally than it now is in *Jasmineæ*, to which it has been removed on account of its diandrous flowers, and supposed erect seed. The flowers correspond but not the position of the seed; and the capsule, both as to structure and dehiscence, is so remote from that fruit of Jasmineæ as altogether to over-balance the single character of diandrous flowers in a didynamous order, in which the abortion of at least one stamen is so constant. Taking this view of its affinities, I have finally determined to leave it in the Bignonal group, raising it for the present to the rank of a sub-order only, until it has been better examined, or perhaps, now that its structure is better known, relations are found to raise it and them to the first rank.

Character of the Sub-order. Calyx tubular, persistent, 5-lobed, at first slightly, afterwards more distinctly two-lipped (owing to the enlarging ovary splitting it on each side). Corolla hypogynous, monopetalous, salver-shaped; tube cylindrical; limb spreading, 5–7-lobed (lobes obovate, cuniate, sub-emarginate). Stamens 2, inserted within the tube, incluse; filaments short; anthers oblong, 2-celled; cells parallel, contiguous, dehiscing longitudinally. Ovary free, 2-celled; ovules 4 in each cell, pendulous from near the apex of the septum. Style about the length of the tube; stigma bifid. Capsule obovate, cuniate, very obtuse above, hard, rough, woody, 2-celled, dehiscing loculicidally (through the middle of the partition as in *Acanthaceæ*), valves septiferous. Seed 4 in each cell, pendulous from the apex, oblong, ending below in a long sub-lanceolate wing; testa smooth, endoplura somewhat thick, spongy, embryo exalbuminous, radicle short, next the hilum, cotyledons oblong, fleshy, longitudinally plaited.—A tree with opposite, exstipulate, pinnate leaves, trichotomous panicles, minute bracts. "Flowers small, variegated, white and brown, fragrant, especially during the night." Roxb.

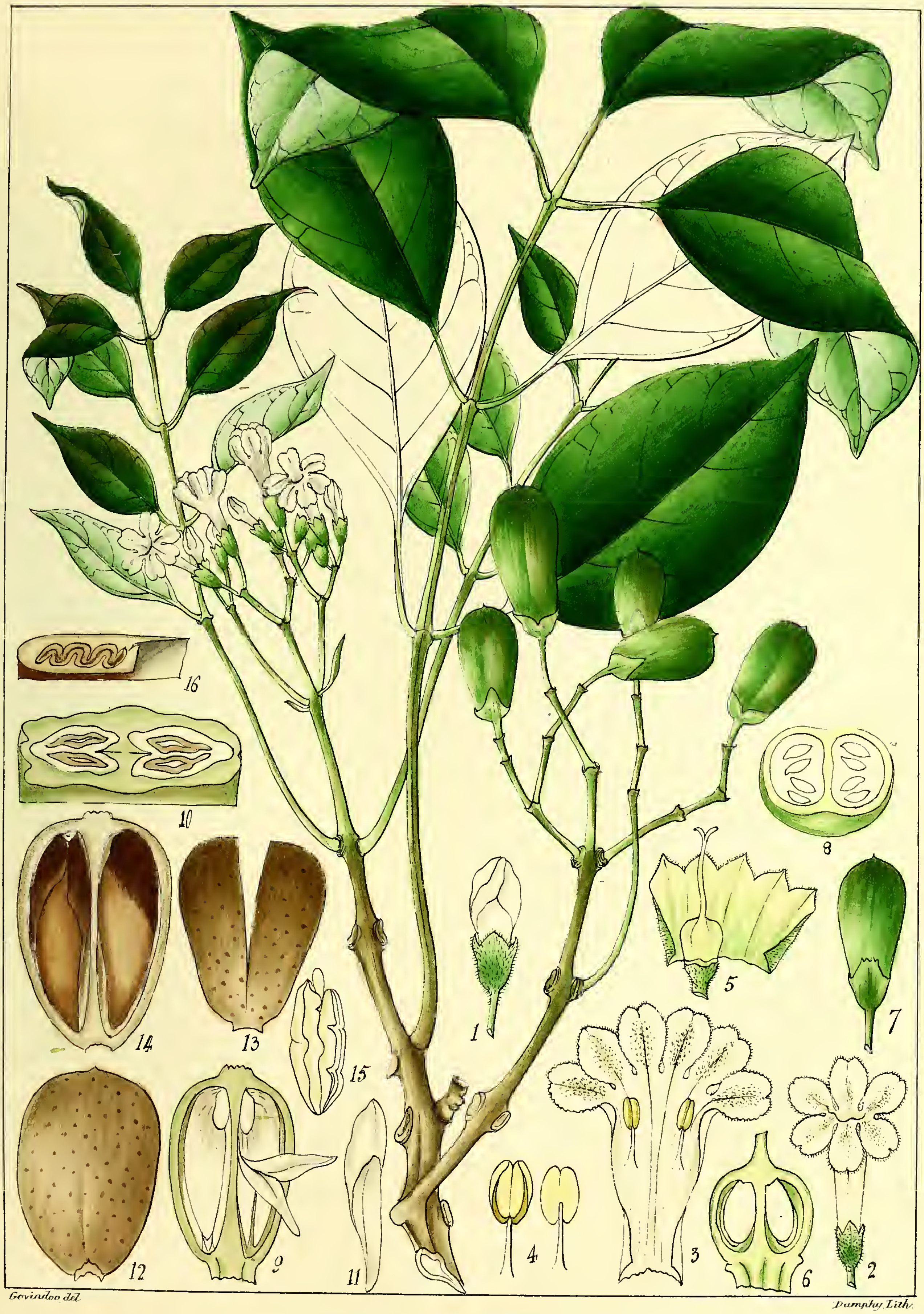
Roxburgh's specimens were from the Circars. Those from which the accompanying drawings were made, I gathered in Mysore, and I can recall having once seen the tree on the eastern slopes of the Neilgherries, below Kotergherry, but not in flower. I never, so far as I can now recollect, met with it growing in the Circars in the jungles of which it would, from Roxburgh's account, appear to abound. It is rare in Southern India.

My analysis of the ovary (Plate 162) is less perfect than I could have wished, owing to nearly all the flowers on my solitary specimen being injured by insects; I had, therefore, to use young fruit, of the size represented, fig. 7, from which the figures 8, 9, 10 and 11 were taken.

Further explanation of that plate seemes scarcely necessary, beyond merely remarking that No. 15 is the cotyledons denuded of their covering, and 16, a cross section of a full-grown seed, showing the thickness of the endoplura and plaited cotyledons.

CXII.—PEDALIACEÆ.

This small order of herbaceous plants was first indicated in 1810 by Mr. Brown in his Prodromus. It has since been enlarged by the addition of the section *Sesameæ*, which, so far as I understand his observation under the ordinal character, he did not intend to include, but which seems better placed here than in *Bignoniaceæ*, in which Endlicher has stationed it. De Candolle adopted the order under the name of *Sesameæ* including the original *Pedalineæ* as a tribe in place of the primary order, a proceeding which has not been adopted by other authors. It is a curious order and, unless examined at a very early stage, before the corolla exceeds the length of the calyx, can scarcely be correctly understood. At that early stage the ovary is one-celled, with 2 or 4 rows of ovules, but as it advances it becomes, by the growth of partitions, divided into 2 or 4 cells. Two genera only are natives of India, *Sesamum* and *Pedalium*, the ovary of the former, at the period of impregnation, having 4, the latter 2 cells. The ovary in both genera is composed of 2 carpels, placed anterior and posterior to the axis. At the above mentioned early stage, the carpels of the former are each furnished within on the back with a thickened line, the dorsal nerve, which, as the ovary enlarges, extends to the centre forming a spurious partition, as in *Bignoniaceæ*, having like them a row of seed lying on each side. By this secondary process the ovary becomes 4-celled all except the point. The difficulty of understanding the true structure is afterwards increased by the firm union of the two carpels, and the loculicidal dehiscence of the mature capsule through the middle of the spurious partition, presenting the appearance of right and left carpels and septicidal dehiscence. The placentæ of the 4 edges of the 2 carpels usually meet and adhere in the centre, forming a 4-sided column easily separable (like the placenta of Bignoniaceæ), with a row of seed on each angle. That this 4-sided placenta is thus formed, I have ascertained from occasionally finding it split along the middle (the placenta of each carpel not having adhered to the opposite one), thus showing its compound structure. The structure of Pedalium is similar in kind but wanting the thickening in the middle of the carpels, remains 2-celled, and the 4-sided capsule, becoming hard and woody, is indehiscent, and the angles furnished with 4 strong spines; presenting, when cut across, a most inexplicable appearance, one being altogether at a loss how to account for the production of



Govindoo del. Dumphy Lith.

SCHREBERA SWIETENOIDES (ROXB.)

the spines. Other genera of this small order are even more inexplicable than this, unless examined at a similarly early stage of their development. These I pass unnoticed, not being Indian plants.

Character of the Order. Calyx equally 5-lobed. Corolla monopetalous, hypogynous, irregular, throat ventricose, limb bilabiate, the limb subvalvate in æstivation. Disk hypogynous, fleshy, or sometimes glandular. Stamens included within the tube, didynamous, with the rudiment of a fifth. Anthers adnate, 2-celled; connective articulated with the filament, slightly prolonged beyond the cells, glandular at the point. Ovary seated on a glandular disk, formed of 2 carpellary leaves, anterior and posterior as regards the axis, at first 1-celled afterwards divided into 2–4 or 6 spurious cells. Style 1, simple, stigma bilamellate. Fruit capsular or drupaceous, dehiscent or indehiscent, few- or many-seeded; seed (in *Sesamum* attached to an easily separable, 4-sided, central placenta) winged or wingless, exalbuminous, embryo straight; cotyledons plano-convex, longer than the radicle. Herbaceous plants, often with soft texture and heavy smell, covered with glandular hairs or quaternary vesicles. Leaves opposite or alternate, undivided or lobed, without stipules. Flowers axillary, solitary or clustered, usually large, furnished, in many cases, with conspicuous bracts, sometimes with glands on the pedicels.

Affinities. These plants seem closely allied to *Bignoniaceæ*, a point on which all Botanists appear to be agreed. Lindley remarks that the only real differences that can be found between them and Bignonals consist in their parietal placentæ, their wingless or nearly wingless seeds, which in most cases are definite, and sometimes in their woody lobed placentæ, which spread and divide variously in the inside of the pericarp, so as to produce an apparently 4- or 6-celled fruit, out of a 1-celled ovary. He further well remarks, "It is not a little remarkable that such observers as De Candolle (Prod. 8. 249) and Endlicher, (Linnœa 7. 8) should suppose the fruit of this order, to be formed out of 5 or 4 carpels, a statement entirely opposed to both theory and fact, it being really composed of an anterior and posterior carpel, exactly as that of the other orders of this present Alliance." As regards the alleged difference of placentation, the case is not clearly made out; on the contrary, I am disposed to view the placentation as nearly, if not quite, similar in kind in both orders, and as regards the seed, the genus *Sesamopteris* is separated from *Sesamum*, mainly on that character, "semena compressa ală membrancea cincta," DC. The differences, therefore, between the two orders seem to be very slight; habit having, apparently, as much to do with their separation as structure.

Geographical Distribution. The few species appertaining to this order, about 25 or 30, are all tropical or sub-tropical, but very widely diffused over the world. In Africa they are most numerous, but America, Asia, and Australia all have their species; five or six are natives of India.

Properties and Uses. The gingilie oil of India is obtained from the seed of *Sesamum Indicum*, and is in general use among the natives, when fresh, as an eating oil. The leaves of *S. prostratum* and *Pedalium murex*, render water in which they are agitated thick and mucilaginous, and are therefore in some repute as demulcents and refrigerants in ardor urinæ.

Remarks on Genera and Species. The only species on which I can venture to offer any remark is *Ses. prostratum*. Of this plant Pluknet published a very good figure in 1705, upwards of 140 years ago, but, of course, at that time, it was imperfectly described. In 1774 Retz published a good character and description, quoting Pluknet's figure. In 1800 Willdenow reduced it, curtly remarking: "*S. prostratum*, Retz, est planta mihi valde dubia, convenit enim pluribus notis cum *Torenia Asiatica*." (! !) It thence remained unacknowledged until 1821, when Roth restored it to its place in the genus; and in 1825 Sprengel confirmed his opinion by adopting it and admitting the species into his system of plants. Such being the case, it was with considerable surprise I found it thus entered in DC.'s Prod. in 1845: "*Sesamum prostratum*, Retz,=ex Willd. (sed negante, Roth.) *Torenia Asiatica*." This species is not uncommon on the sands behind the beach at Madras, and along the coast there. It lies flat on the ground, is very hirsute,

with small, roundish, crenato-dentate leaves, and rather large, brownish-purple flowers. *Sesamum luteum*, Retz, is still looked upon as an imperfectly known plant, as it does not appear to have been found since he described it.

EXPLANATION OF PLATE 163.

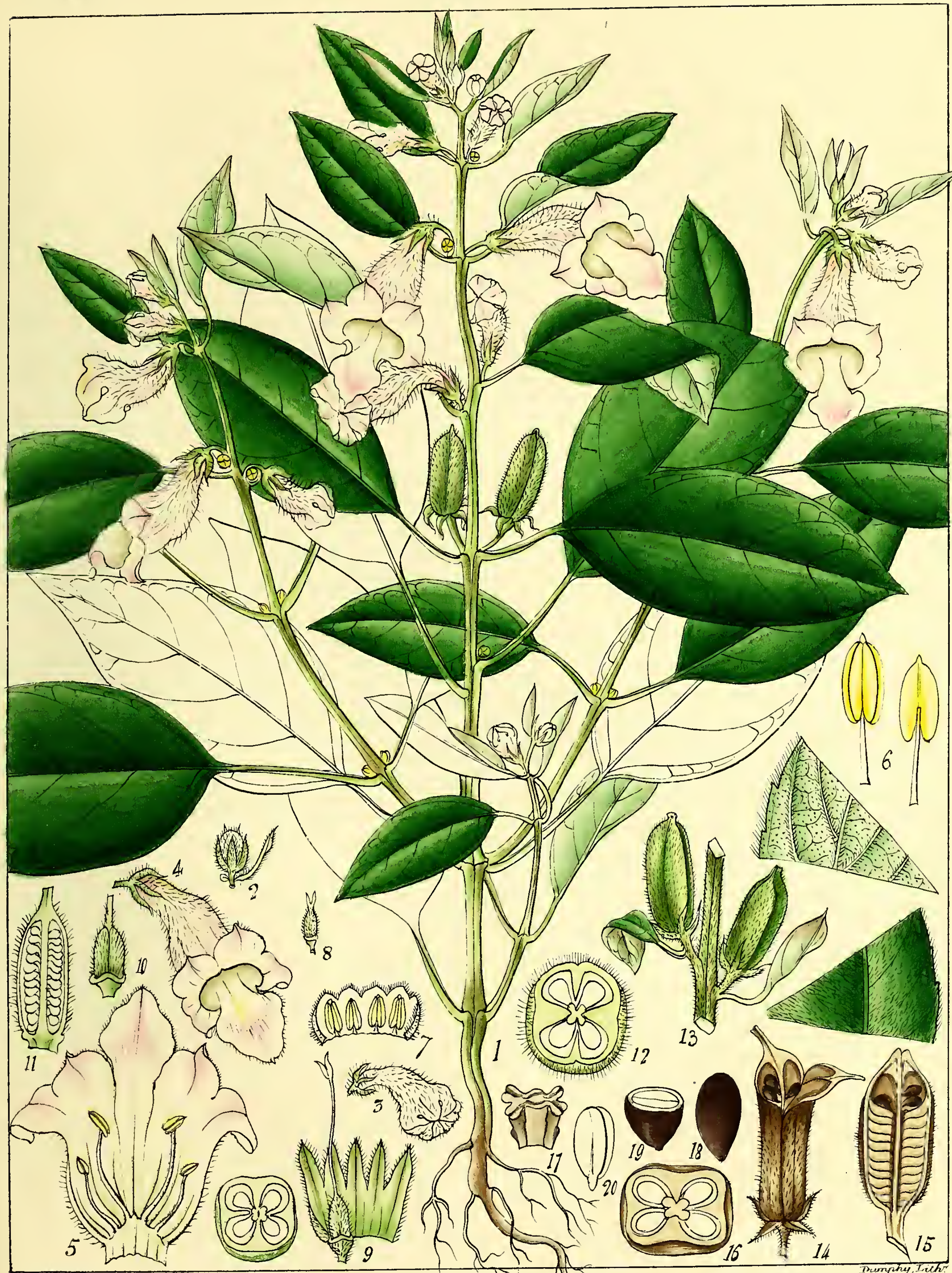
Sesamum Indicum (DC.).

1. A small flowering plant, natural size.
2. A very young flower-bud.
3. A flower more advanced.
4. One full blown. 5. Corolla split open.
6. Anthers, apiculate.
7. Corolla of fig. 2 detached and split open.
8. Ovary of fig. 2 cut transversely.
9. Ovary and calyx of an expanded flower.
10. Ovary detached and slightly magnified.
11. 12. Cut longitudinally and transversely, in 12 a little stretched to show the origin of the spurious dissepiment.
13. Mature capsules.
14. Capsule in the state of dehiscence.
15. One valve of the capsule with the seed and spurious partition in situ, showing the last free from the intermediate true partition.
16. Ripe capsule cut transversely.
17. A portion of the placentæ which separates after shedding the seed.
18. A ripe seed.
19. The same cut across.
20. Detached embryo.

CXIII.—ACANTHACEÆ.

This order was first indicated by Jussieu, but was at that time so little known that seven genera were found sufficient to include all the then known species. Brown subsequently added a few, as did Willdenow and others; but still, in 1830, when Bartling published his list, they scarcely amounted to 20. About that time Dr. Wallich placed the Indian division of the order in the hands of Professor Nees Von Esenbeck for description, when he, after an elaborate examination, raised the number for the Indian species alone to 56; and in 1840, when Endlicher's Genera Plantarum was completed, the number was raised to 80. In 1847 Nees published in DC.'s Prodromus a monograph of the whole order, which embraces 155 genera and about 1500 species. In this generally most masterly production he has on some occasions, perhaps, drawn the lines of demarcation between some of his genera too fine, rendering it probable that some of them may require to be reduced; but on other occasions it seems equally probable that others may and will be divided. But be that as it may, this order furnishes a striking instance of the rapid advances now making in botany, and of the wonderful impulse which has, within the last 20 years, been given to this branch of science. To the Indian Botanist this is an interesting, but difficult, order, owing to the number of indigenous species, which are found in all parts of the country and in nearly all situations, inhabiting alike the marsh and most arid ground, the sea beach, and the tops of the highest mountains.

Character of the Order. Calyx pentamerous, the odd sepal posterior, sometimes the two anterior ones united, hence 4- or 5-divided, sometimes, but rarely, nearly obsolete, entire or several toothed. Corolla monopetalous, hypogynous, 5-cleft, the segments alternate with the sepals; limb usually bilabiate, but sometimes regular, 5-lobed, contorted in æstivation. Stamens inserted on the tube at different heights, sometimes near the base, about the middle, or on the throat, either didynamous, the 5th rudimentary or altogether wanting, or often only two antheriferous; filaments filiform, sometimes united by pairs at the base, or even monadelphous; two- or sometimes one-celled, cells contiguous, parallel or superposed, or variously divaricated, occasionally one of them sterile, dehiscing longitudinally. Ovary free, dicarpellary, two-celled, the septum formed of the inflexed margins of the carpels, either complete (meeting in the axis) or somewhat incomplete; cells anticous and posticous with respect to the axis of inflorescence, often spuriously stipitate from the obliteration of the lower half of the cells, sometimes rostrate at the apex. Ovules 1–2 or several in each cell, sessile or borne on processes of the parietal placenta; style terminal, filiform, simple; stigma entire or 2-lobed. Capsule 2-celled, of various consistence, unguiculate or rostrate, bursting elastically; dissepiment opposite the valves, separating in two pieces through the axis (the middle sometimes open), usually adnate to the valves, but sometimes separating from them. Seeds usually compressed, 1–2 or several in each



SESAMUM INDICUM (LINN. D.C.)

cell, attached to cup-shaped, subulate or hooked processes (retinacula) of the placenta; testa coriaceous, fibrous or loose, often tuberculate, sometimes pilose; albumen none; embryo curved or straight; cotyledons large, roundish; radicle taper, descending and at the same time centripetal, curved or straight.—Herbaceous plants or shrubs; stem and branches nodosely jointed; hairs when present simple, capitate or jointed; leaves often beset with white hair-like lines (lineoles) under the epidermis which, after breaking the cutula, effervesce on the application of an acid. Leaves opposite or, rarely, in fours, exstipulate, entire or serrated, rarely showing a tendency to become lobed, sometimes in unequal pairs. Inflorescence terminal or axillary, in spikes, racemes, fascicles, or panicles. Flowers usually opposite on the spikes, or sometimes alternate, furnished with 3 bracts, of which the lateral pair are now and then deficient; bracts often large and foliaceous, and then the calyx is usually much diminished in size.—This large and complex order is essentially distinguished from all others by its elastic, 2-valved capsules and retinacula or placentary processes to which the seeds are so generally attached: for it may truly be said that by these alone it is separated from all others, though it must at the same time be admitted they are not altogether without exceptions; these however are so few as hardly to militate against the general rule.

Affinities. I have placed this order next *Pedaliaceæ* (at the end of the Bignonal group) as forming, through *Sesamum*, an almost direct transition to that group of orders. *Acanthaceæ* certainly want the spurious partition which divides the 2-celled ovary and capsule of Sesamum into a 4-celled fruit; and Sesamum is, in like manner, deficient in the retinacula, so remarkable in this family, but otherwise the capsules are very similar; in both the dehiscence is contrary or through the axis of the septum which remains attached partly to both valves; in both the seed are arranged in two rows in the cells and are exalbuminous; and, as regards the flowers, it is almost impossible to draw distinctions in a family where almost every form and variation are to be met with, but in both they are irregular. *Pedaliaceæ* and *Acanthaceæ* being thus closely allied, it follows that the nearest affinities of *Acanthaceæ* are *Bignoniaceæ*, on the one side, and *Pedaliaceæ* on the other, to which I would add *Schrebereæ*, which I now view as the type of an order, but for the present reduce to a sub-order appertaining to this group. Formerly *Acanthaceæ* were considered rather nearly allied to *Scrophulariaceæ*, but from which they are removed by their parietal, not axile, placentation and exalbuminous seed. But though these two great orders of irregular flowered plants are thus kept distinct by characters, they occasionally so far interblend in habit that they might, but for the fructification, be mistaken for each other. Hence, having the characters of the Bignonal set of orders strongly marked, and to some extent the habit of *Scrophulariaceæ*, they seem to occupy a suitable station here, as forming the connecting link between them.

Geographical Distribution. This is a, peculiarly, tropical order, for, though not confined to the tropics, they rarely extend beyond the warm regions bordering them. Two or three are found in Southern Europe and North America, and some in Australia. In India, tropical America, and Africa, they abound. In the Indian peninsula the proportion of *Acanthaceæ* equals or perhaps exceeds, in the number of its species, most other dicotyledonous orders; *Legumenosæ*, and perhaps *Compositæ*, being, I fancy, almost the only ones by which it is, to any considerable extent, exceeded. As regards Southern India, I suspect species of the *Acanthaceæ* are about as numerous as those of *Compositæ*. They are found in all soils and situations, wet and dry, in shade and exposed to the strongest light, and equally on the sea shore and tops of our highest mountains: they are numerous on the highest ranges of the Neilgherries. Their forms are equally variable, ranging from very minute herbs up to moderate sized shrubs.

Properties and Uses. These are not important. Some, such as *Andrographis paniculata* (Justicia Lin). or *Creat*, possess medicinal properties of considerable energy, the plant named being intensely bitter and as such used, either singly or in combination, as a tonic. Some are used in the arts as dyes, and several are most deservedly admitted into the parterre, as affording most ornamental subjects for the garden and flower border. But more generally they can at best be designated as weeds, having neither use nor beauty to recommend them to our attention.

Remarks on Genera and Species. Under this head there is considerable scope for observation, and were such desirable, I think I could easily adduce several instances where it will be found the genera are unnecessarily multiplied, and characters, which would have served to distinguish the limits of one genus, virtually lost by being divided among two or more. But while I thus question the goodness of several of Professor Nees' genera, I must at the same time admit that the difficulty of defining the limits of genera in an order so exceedingly natural, is always very great, and that had Nees never written another article on Botany than that monograph, he would still have rendered such a service to the science of plants, as might well suffice to immortalize his name as one of the brightest ornaments of the long list of those who have contributed to advance our knowledge of the Vegetable Kingdom.

He divides the order into 2 sub-orders and 11 tribes. These latter, unavoidably, sometimes run into each other so as to render their limitation almost impossible; but as all of them have Indian representatives, I shall endeavour, as far as possible, to aid those who may be desirous of studying the order in recognizing them, by giving analized figures of at least one genus of each; and I may here mention that upwards of 100 species are figured in my Icones, for the most part accompanied with copious analyses of the parts of fructification.

The following is Professor Nees' Conspectus of the tribes.

Sub-order Anechmatacantheæ.

Seed not supported on retinacula.

Tribe I. Thunbergieæ. Seeds few, in a thick capsule: attached to a cup-shaped process of the placenta in place of to a retinaculum.

Tribe II. Nelsonieæ. Capsule many-seeded. Seed small, attached to a hairlike funiculus.

Sub-order Echmatacantheæ.

Seeds supported on hooked processes (retinacula).

Tribe III. Hygrophileæ. Calyx 5-cleft. Corolla ringent. Stamens 4, didynamous, rarely only 2 fertile; cells of the anthers parallel. Capsule narrow, many-seeded from the base.

Tribe IV. Ruellieæ. Calyx 5-cleft. Corolla sub-regular, scarcely two-lipped, tubular, funnel-shaped or sub-companulate. Stamens 4, didynamous, one pair often much shorter, sometimes 2 by abortion; cells of anthers parallel. Capsule 2–4- or many-seeded, usually contracted at the base. Flowers axillary, typically cymose, or solitary by abortion, usually bibracteolate, sometimes racemose; racemes secund.

Tribe V. Barlerieæ. Calyx 4-parted, lacineæ unequal or 2-lipped. Corolla funnel-shaped, or 2-lipped. Stamens 4, inserted into the apex of the tube, didynamous, one pair very short or wanting by abortion; cells of the anthers parallel. Capsule 4-seeded at the base. Flowers axillary, cymulose, bibracteolate secund.

Tribe VI. Acantheæ. Calyx 4-parted, segments unequal. Corolla 1-lipped, tube cartilaginous. Stamens 4, didynamous; anthers 1-celled capsule 4-seeded at the base. Flowers spicate bracteate and bracteolate.

Tribe VII. Aphelandreæ. Calyx 5-parted, regular. Corolla bilabiate or ringent, or somewhat regular, infundibuliform. Stamens 4, nearly equal; anthers 1-celled, narrow. Capsule 4-seeded from the base, or in the middle. Flowers spiked bracteate and bracteolate.

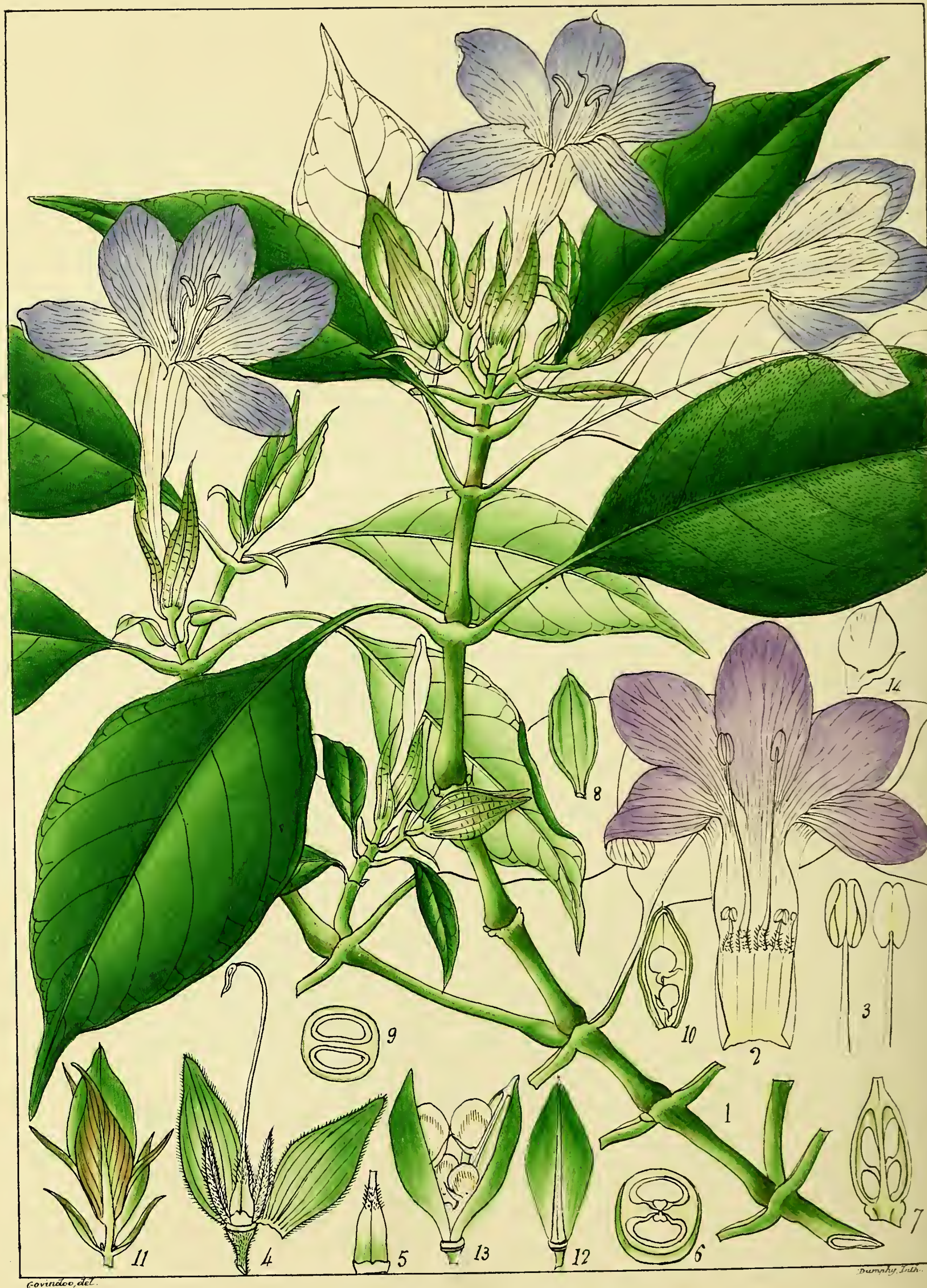
Tribe VIII. Gendarusseæ. Calyx usually deeply 5-cleft, regular, the dorsal lobe sometimes smaller or wanting. Corolla bilabiate or ringent. Stamens inserted on the base of the tube, either 4, didynamous, or 2; anthers 2-celled; cells parallel or separate, muticous or spurred at the base, sometimes 1-celled, capsule narrow, compressed, sterile at the base, 2- or several-seeded above. Flowers axillary, sessile or sub-sessile, spiked or racemose. Bracts and bracteoles various.

Tribe IX. Erantheme æ. Calyx 5-cleft, regular. Corolla salver-shaped, limb regular or sub-bilabiate, tube long. Stamens 2, perfect, inserted on the apex of the tube; anthers 2-celled; cells parallel. Capsule narrow and sterile to about the middle, 4-seeded. Flowers axillary, sessile or spicate.

Tribe X. Dicleptereæ. Calyx 5-parted, regular. Corolla either bilabiate or infundibuliform, with a regular limb. Stamens usually 2, sometimes 4, didynamous; anthers 2-celled, cells either parallel or one above the other; sometimes 1-celled. Capsule with 2 or 4 seed, about the middle the partition, sometimes separating with elasticity from the valves. Flowers collected into one or several-flowered, involucrate, peduncled, axillary, typically cymose, capitula. Cymes becoming, by evolution, racemose. Involucre leaves often two-valved at the apex.

Tribe XI. Andrographideæ. Calyx 5-cleft, regular. Corolla bilabiate or ringent, stamens 2; lower cell of the anthers bearded or wooly, sometimes obliterated by the wool*, capsules depressed, many-seeded from the base. Flowers axillary, solitary or racemose.

* This statement rests on an error of observation; fig. 12, plate 164–b, is one of plants said to have the lower cell of the anther obliterated by wool, whereas both cells are perfect, and the tuft of wool borne on the back of the anther.



Govindoo, del. Dumphy, Lith.

BARBERIA INVOLUCRATA (NEES)

I. THUNBERGIEÆ. II. NELSONIEÆ. III. HYGROPHILEÆ. IV. RUELLIEÆ. V. BARLERIEÆ.

VI. ACANTHEÆ. VII. APHELANDREÆ. VIII GENDARUSSEÆ. IX ERANTHEMEÆ. X DICLIPTEREÆ.

EXPLANATION OF PLATE 164.

1. *Barleria involucrata*, flowering branch.
2. Corolla split open, stamens in situ.
3. Back and front views of the large anther.
4. Calyx and ovary.
5. Detached ovary.
6. and 7. Cut transversely and longitudinally.
8. A half-grown capsule.
9. 10. Cut transversely and longitudinally, showing two of the young seed in situ.
11. A full-grown capsule with the persistent calyx.
12. The same detached.
13. In the state of dehiscence.
14. A detached seed with its retinaculum.

EXPLANATION OF PLATE 164-b.

1. Thunbergieæ. *Meyenia Hautayniana.* (Nees.)
2. Nelsonieæ. *Ebermaiera glauca.* (Nees.)
3. Hygrophileæ. *Hemiadephis polysperma.* (Nees.)
4. Ruellieæ. *Endopogon versicolor* (R. W.), and *Strobilanthus sessilis.* (Nees.)
5. Barlerieæ. *Lepidagathis cristata.* (Willd.)
6. Acantheæ. *Blepharis Boerhaavifolia.* (Juss.)
7. Aphelandreæ. *Crossandra axillaris*· (Nees.)
8. Gendarusseæ. *Gendarussa Tranquebarensis.* (Nees.)
9. Eranthemeæ *Rhinacanthus communis.* (Nees.)
10. Dicliptereæ. *Dicliptera bivalvis.* (Juss.)
11. Andrographideæ. *Andrographis lobelioides.* (R.W. Erianthera lobelioides. Nees.)

CXIV.—SCROPHULARIACEÆ.

This is an order of great extent, including about 180 genera and 2000 species of plants. It was first indicated by Jussieu, but divided by him into two orders, *Scrophularieæ* and *Pediculares*, orders which, at their extreme points, seem sufficiently distinct, but which, when compared throughout, are found to interblend at so many points as to render separation unadvisable; hence nearly all Botanists are now agreed on the propriety of uniting them.

The essential characteristics of the order are, corolla monopetalous, usually more or less irregular: stamens two or 4, didynamous: ovary free, 2-celled with axile placentæ: capsule 2-valved: seed numerous, minute, albuminous. In an order of such vast extent there must of course be various exceptions to these marks, but I fancy it may be safely stated that no plant in which they meet, belongs to any other order. Two others, however, do occasionally become so far interblended, at certain points, as to render their discrimination difficult; though in reality the three orders are all essentially distinct, and for the most part easily distinguishable: the two to which I allude are *Orobanchaceæ* and *Solanaceæ*.

The former is distinguished by its one-celled ovary and parietal, inflexed placentæ, aided by the very remarkable habit of the plants; the latter by its regular, plicate corolla, and 5 fertile stamens. Boundaries so fine as these are of course easily overstepped; hence, in the one case, we find *Harveya* and *Aulaya*, Cape genera, referred by some to *Scrophulariaceæ*, and by others to *Orobanchaceæ.* I coincide with those who adopt the latter view, though in *Striga Orobanchoides* we have a true Scrophularinous plant, with the parasitic character and habit of *Orobanchaceæ.* And in the other case, *Verbascum* and *Celsia* are by many referred to *Solanaceæ*, whose essential character is to have regular, pentandrous flowers, free, 2-celled, superior ovaries, with axile placentation. As regards the corolla, in *Scrophulariaceæ*, there seems no end to its variations. In *Veronica* it is nearly regular; while in Lady's Slipper, Snap-dragon, and Larkspur, it is most irregular. I copy from Mr. Bentham's monograph of the order, in De Candolle's Prodromus, the following—

Character of the Order. Flowers hermaphrodite, usually irregular. Calyx free, persistent, 5–4 merous. Corolla monopetalous, hypogynous, pentamerous, or by union of the upper lobes, tetramerous, rarely 6–7 merous or, by the union of the lobes, 2-lipped; æstivation bilabiate or irregularly imbricate, the upper lobes either exterior or within, very rarely, in some of the diandrous or didynamous genera, plicate. Stamens inserted on the corolla, alternate with its lobes, the upper one very often, and sometimes also the two anticous or posticous, sterile, or deficient, the remaining ones usually in equal pairs; anthers 2-celled, either confluent or dimidiately one-celled; cells dehiscing longitudinally. Ovary free, 2-celled; ovules numerous in each cell, inserted near the axis of the partition, anatropous or amphitropous; style simple or shortly bifid, the stigmatic portion slender or thickened, entire, or 2-lobed. Fruit capsular with various

dehiscence or rarely baccate. Placenta 4, either separating during dehiscence, or variously united between themselves, or with the margins of the valves, or with the central column. Seeds albuminous; with the embryo straight, or rarely curved; sometimes indefinite with the radicle directed to the hilum; sometimes few or definite with the hilum more or less lateral, and the radicle directed to the apex of the fruit.—Herbs, undershrubs or shrubs; lower leaves opposite or whorld, the upper ones alternate, sometimes all opposite or all alternate, venation and clothing very variable; stipules, usually, none. Flowers axillary or racemose, rarely spiked: peduncles opposite or alternate, sometimes simple, 1-flowered, sometimes many-flowered in dichotomous cymes. Bracts 2, opposite at the ramifications of the cymes, solitary under the pedicels, no bracteoles on the pedicels, or 1–2 alternate, or 2 opposite under the calyx: two opposite, on a 1-flowered peduncle, indicates a cyme reduced to a single flower.

Affinities. On this head Botanists seem generally pretty well agreed, nearly all the more recent expositors of the natural arrangement associating this order with those immediately preceding. Endlicher forms of them his class *Personatæ*: Lindley's *Bignonal alliance* is, with the exception of *Orobanchaceæ*, composed of the same series of orders, and Meisner's class; *Labiatiflore*, includes them and the other labiate-flowered orders. All of them however exclude *Solanaceæ* from their respective groups, though so nearly associated by characters that Mr. Bentham finds some of the genera can only be excluded by artificial characters, generally esteemed of inferior importance. This exclusion rests on the circumstance of *Solanaceæ* having symmetrical, pentamerous flowers, while all the others have them unsymmetrical; thus presenting perhaps one of the best proofs that can be adduced of the importance of variations of the floral structure in the formation, not of single orders but of groups of orders, where individual variations become overlooked or lost in the mass and reduced to their proper level, that of generic or sectional value. Endlicher's 36th class of *Tubifloreæ* embraces a group of regular-flowered orders, at the end of which he places *Solanaceæ;* while *Scrophulariaceæ* stands at the head of his 37th, *Personateæ;* thus placing these two very nearly allied orders next to each other while still preserving the distinction which the marked difference in floral structure furnishes. This arrangement I look upon as one of the best yet proposed, since the two orders very nearly coincide in the structure of their ovaries, fruit, and seed, while essentially differing in their flowers.

Geographical Distribution. Few orders have a more extended distribution than this, no part of the world, between Melville Island and Terra del Fuego, being without them. In Europe and North America they abound, and are, if not positively common, yet everywhere to be met with in India, but most frequently in wet or marshy ground. The number of species found in India is, however, inconsiderable, in comparison with the frequency of individuals of each species. They however are found equally in the marsh, on the most arid plains, and on the cool tops of the highest mountains, exposed to the full blaze of the sun and the deep shade of the forest.

Properties and Uses. These are not important except in the case of Digitalis, the properties of which are very peculiar and, as a remedial agent in some forms of disease, very important. Acrimony and bitterness are qualities not unfrequently met with in species of this order, and in such intensity as to cause, when carelessly administered, violent vomiting and catharsis. Of the Indian species, one has got credit for being a remedy in cases of Diabetes. The evidence on which this statement rests is, it must be confessed, rather inconclusive, but as Diabetes is the most intractable of diseases, and at the same time allows ample time for trying remedies, I have selected that species for illustrating the order, in the hope, that, by making it known, its qualities may be brought to the test of well-conducted experiment. The plant is a native of Mysore and Balaghaut provinces, grows among long grass or bushes up which it climbs, spreading, in the former case, to the extent of several feet all round the root. The specimens from which the accompanying drawing was made, I gathered on the top of the Copper Mountains at Bellary, in October and November, twining among tufts of grass.

Though thus sparingly employed for medicinal or economical purposes; several find favour with amateurs of fine flowers, and well deserve this distinction.

Remarks on Genera and Species. In orders of such vast extent it is impossible, by any amount of remarks, for which I could find space in this work, to convey an adequate conception of its peculiarites. I shall, therefore, here, as in some preceding instances, endeavour to do so by means of the pencil rather than by the pen, and with that view give, as illustrations of each of Mr. Bentham's tribes, natives of India, figures of the flowers and analyses generally of the generic characters of one or more genera of each tribe. These I conceive will be more useful and instructive to the student than better looking, but much easier executed figures of three or four species, however well selected or graphically executed.

The following is Mr. Bentham's synopsis of the characters of the tribes into which he has distributed the genera of this extensive and difficult order. I give the conspectus complete, but will only illustrate those having Indian representatives.

CONSPECTUS OF THE TRIBES.

Sub-order Sulpiglossideæ.

Tribe I. Sapiglosseæ. Æstivation of the corolla plicate or imbricato-bilabiate, the posterior lip (as regards the primary axis) exterior with the sinuses often plicate. Inflorescence at first centrifugal.

Sub-order Anterrhinideæ.

Æstivation of the corolla imbricato-bilabiate the posterior lip exterior. Inflorescence either centripetal or compound, the divisions forming centrifugal cymes (cymes sometimes reduced to a single flower on a jointed peduncle with two opposite bracts) the primary one a centripetal thirse.

Tribe II. Calceolarieæ. Corolla 2-lobed, lobes entire, concave. Calyx valvately 4-lobed. Inflorescence compound. Leaves opposite or whorld.

Tribe III. Verbasceæ. Corolla rotate, two-lipped, lobes flat, efossulate. Stamens declinate. Inflorescence centripetal, uniform. Leaves alternate.

Tribe IV. Hemimerideæ. Corolla rotate or rarely tubular [i. e. a tube distinct from the limb] bilabiate, with a saccate or calcarate fossula. Capsule 2-valved. Inflorescence centripetal, uniform. Leaves, the lower ones at least, opposite or whorld.

Tribe V. Antirrhineæ. Corolla tubular, often saccate or spurred. Capsule opening by pores. Inflorescence centripetal, uniform. Leaves, the lower ones at least, opposite or whorld.

Tribe VI. Cheloneæ. Corolla tubular, neither saccate nor spurred. Capsule 2–4-valved (rarely baccate or indehiscent). Segments of the calyx imbricate in æstivation. Inflorescence compound.

Tribe VII. Escobedieæ. Corolla tubular, neither saccate nor spurred. Capsule 2-valved. Calyx large, valvate in æstivation. Inflorescence centripetal, peduncles with opposite bracts. Leaves, the lower ones at least, opposite.

Tribe VIII. Gratioleæ. Corolla tubular, rarely (in Sphenandra) subrotate, neither saccate nor calcarate. Capsule 2-valved, rarely indehiscent. Segments of the calyx imbricate in æstivation. Inflorescence centripetal, uniform, rarely irregularly compound.

Sub-order Rhinanthideæ.

Æstivation of the corolla imbricate, the posterior lip never exterior. Inflorescence either centripetal or compound, or rarely (in a few Buddleias) centrifugal.—In the tribes 9 to 13, anthers always muticous; in the tribes 9 to 14, lobes of the corolla flat.

Tribe IX. Sibthorpieæ. Leaves alternate or with the flowers fascicled at the joints, rarely opposite, not connate, the floral ones either conformable or the upper ones decreasing in size. Flowers axillary, solitary or fascicled, rarely cymose.

Tribe X. Buddleieæ. Leaves opposite, connected by a membrane or transverse line. Flowers cymose or rarely solitary in the axils.

Tribe XI. Digitaleæ. Inflorescence centripetal, racemose. Leaves all alternate, the lower ones petioled, congregate.

Tribe XII. Veroniceæ. Inflorescence centripetal, racemose. Leaves, at least the inferior ones, opposite. Stamens distant. Anthers 2-celled, or by confluence one-celled.

Tribe XIII. Buchnereæ. Inflorescence centripetal, racemose. Leaves, at least the lower ones, opposite. Stamens approximated by pairs, anthers dimidiately 1-celled.

Tribe XIV. Gerardieæ. Inflorescence centripetal, racemose. Leaves, at least the lower ones, opposite. Stamens approximated by pairs. Anthers 2-celled, cells often mucronate, equal, or one of them empty.

Tribe XV. Euphrasieæ. Inflorescence centripetal, racemose. The posterior lip of the corolla galiate or concave, erect.

EXPLANATION OF PLATE 165.

1. *Linaria ramosissima*, flowering branch, natural size.
2. Detached flower.
3. Detached corolla.
4. Corolla split open, stamens in situ.
5. Detached stamens, back and side views.
6. Calyx and ovary.
7. 8. Ovary cut transversely and longitudinally.
9. Mature capsule.
10. Capsule dehiscing.
11. A mature seed.
12. Cut lengthwise, embryo in situ.
13. Cut across.
14. Detached embryo. All more or less magnified.

EXPLANATION OF PLATE 165-b.

1. Verbasceæ. *Verbascum virgatum* (Wither.), and *Celsia Coromandelina.* (Vahl.)
2. Antirrhineæ. *Antirrhinum glaucum.* (J. E. Stocks.)*
3. Gratioleæ. *Stemodia viscosa.* (Roxb.) and *Peplidium humifusum.* (Delile.)
4. Sibthorpieæ. *Glossostigma spathulatum.* (Arn.)
5. Buddleieæ. *Buddeia discolor.* (Roth.)
6. Buchnereæ. *Ramphicarpa longiflora* (Benth.) and *Striga orobanchoides.* (Benth.)
7. Gerardieæ. *Centranthera hispida* (R. Br.) and *Micrargeria Wightii.* (Benth.)
8. Euphrasieæ. *Pedicularis zeylanica.* (Benth.)

CXV.—SOLANACEÆ.

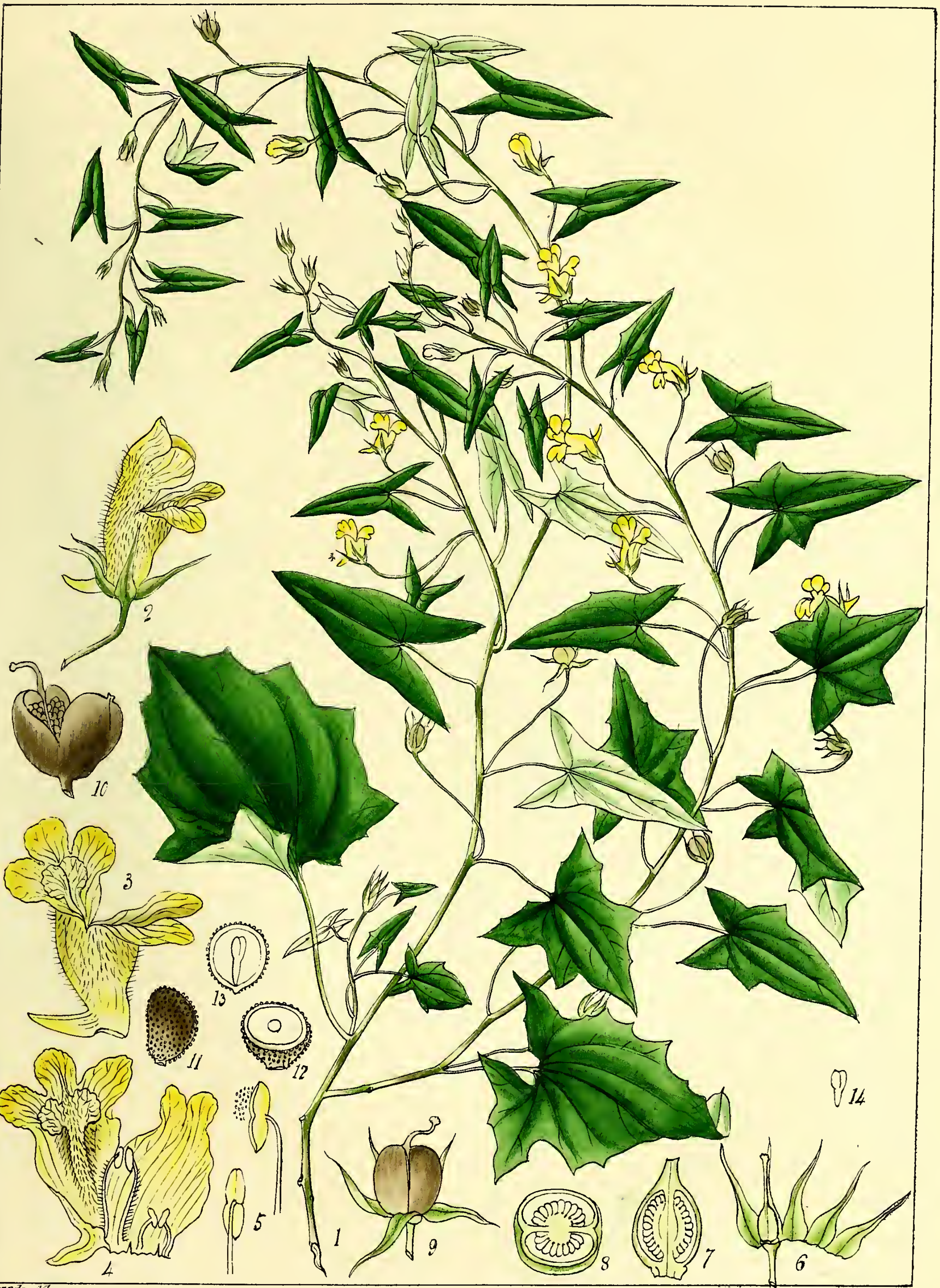
This large and interesting order was first defined by Jussieu. Subsequently Mr. Brown revised and amended the ordinal character, suggesting that it might with propriety be divided by the removal of certain genera which departed in some particulars from those he considered genuine members, and associated under the designation of *Solanæ veræ.*

This suggestion has not been followed by succeeding writers; hence the order is retained nearly in its original form, but greatly augmented. In character and also in habit it agrees in many points with *Scrophulariaceæ*, and, through some of its genera, so closely, that the two orders almost interblend ; but still it must be admitted that they are really distinct, and almost always at once distinguishable by the regular pentandrous plicate corollas of *Solanaceæ*, in comparison with the irregular diandrous or didynamous flowers of *Scrophulariaceæ*, without reference to the embryo and seed. The ovary and fruit are much the same in both, that is, a 2-celled ovary with more or less perfectly axile placentæ, and a capsular or baccate fruit; the latter form, however, being more frequent in the former order. Then, as regards their properties, they scarcely admit of comparison ; those of the one, *Scrophulariaceæ*, being, with a few exceptions, nearly innocuous and comparatively valueless to man, while the other, *Solanaceæ*, furnish some most powerful and valuable narcotics to the Physician, the far-famed Potatoe, as an esculent, to all classes of society, and the soothing Tobacco to the lover of quiet enjoyment. Generally speaking the products of vegetation of this order of plants are in a high degree narcotic and dangerous, a character from which the potatoe is not altogether exonerated though vastly weakened, somewhat on the same principle that blanched lettuce and cellery are deprived of their native poisonous qualities ; the potatoe tuber being in truth a blanched under ground stem, and thereby deprived of the acrid qualities of the family, still found however in the stems and fruit, in which, under the action of solar light, they are to a considerable extent developed.

Viewed simply in its botanical relations, this order does not occupy a prominent place either as regards the number of its genera or species. Lindley enumerates 60 genera as belonging to this family, 9 only of which are found in India. Of these, two are justly esteemed doubtful natives, namely *Nicotiana* and *Lycopersicum* (though both are naturalised), and one is now excluded from the order, reducing the number to six; and one of these even, *Hyoscyamus*, may perhaps be esteemed doubtful.

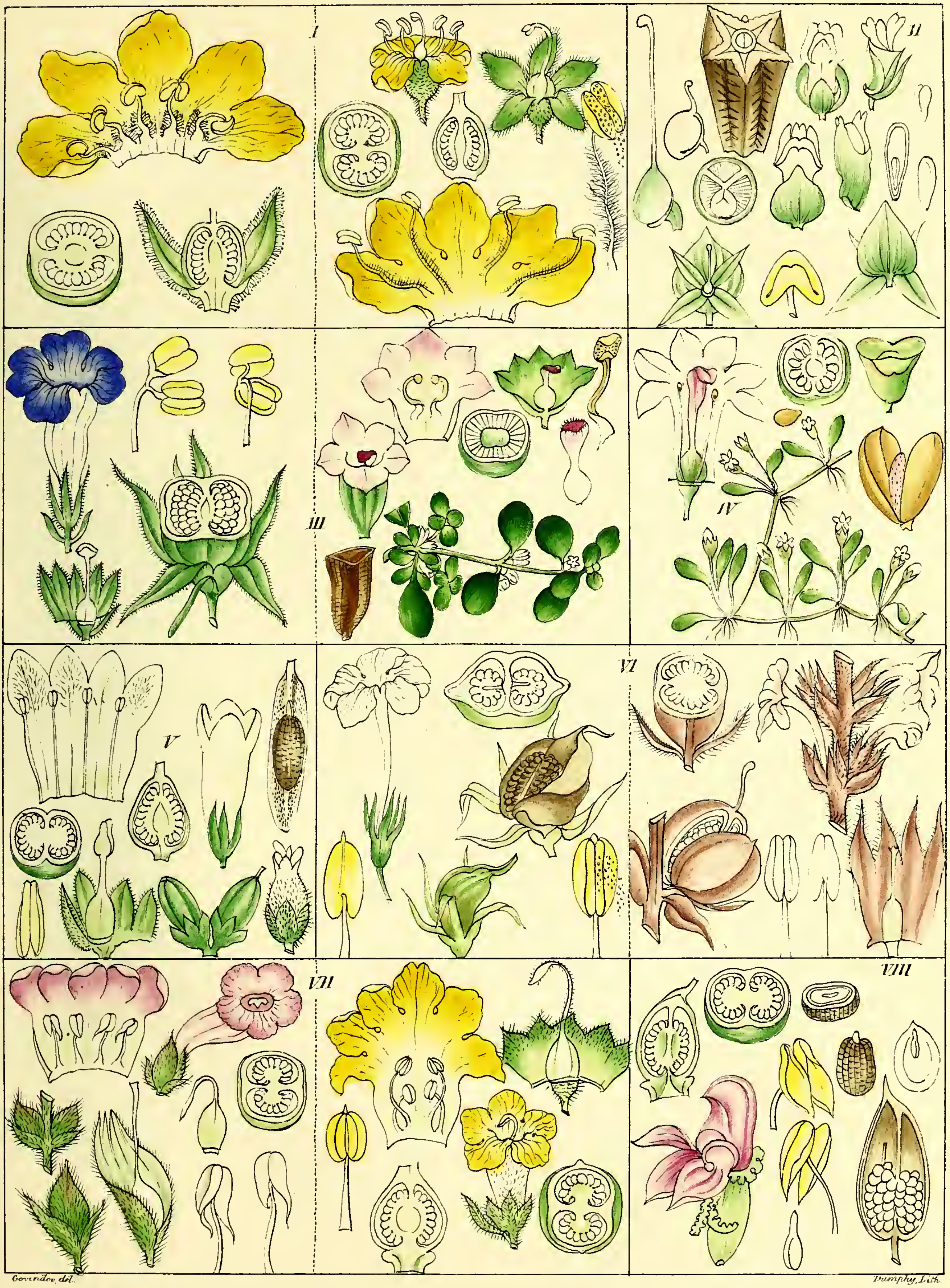
* While revising this sheet for the press I received a note from Mr. Stocks from which I quote the following passage regarding this species.

"Antirrhinum glaucum (J.E.S.), figured from my drawing, is *A. papilionaceum*, Burm. Fl. Ind. Pg. 131, plate 39, f. 2. Differt a reliquis peculiari calyce, &c. Burmann's plant does not seem to have been identified, and Mr. Bentham calls *A. papilionaceum*, 'planta inceri generis' in his table at the end of the genus. I only lately procured Burmann and was struck by the rather good likeness of my plant [my copy is defective and wants that plate, R. W.]. Vide also Griffith's Afghan Journal, page 331, which, when corrected, may be read thus, and evidently refers to this plant which is common in the line of hills where Griffith was. 'A very curious plant (Antirrhinoid) was brought from the hills by Captain Sanders, singular in the inequality of the calyx and the great development of the posticous sepal.'" The plant is figured No. 1459, of my Icones. R. W.



Govindoo, del. Dumphy, Lith.

LINARIA RAMOSISSIMA (WALL.)



I. VERBASCEÆ. II. ANTERRHINEÆ. III. GRATIOLEÆ. IV. SIBTHORPIEÆ. V. BUDDLEIEÆ.

VI. BUCHNEREÆ. VII. GERARDIEÆ. VIII. EURPHRASIEÆ.

Of 900 species mentioned by Lindley as belonging to the order, the Indian collections, distributed by Dr. Wallich, contributed, according to Nees' Monograph, only 52; but that number does not represent all those named in Walpers' list (that from which Lindley derives his numbers), as many of Nees' varieties are there described as species. But after making every allowance, the order must still be viewed as one of secondary, botanical, importance in the Indian Flora.

Character of the Order. Calyx 5-parted seldom, 4-parted, persistent, inferior. Corolla monopetalous, hypogynous, deciduous; limb 5-cleft, seldom 4-cleft, regular or rarely somewhat unequal; the æstivation plaited or imbricate or even valvate. Stamens inserted on the corolla, as many as the segments of the limb, with which they are alternate; anthers bursting longitudinally, rarely by pores at the apex, ovary 2-celled, composed of a pair of carpels right and left of the axis, rarely 4–5- or many-celled, with polyspermous placentæ; style continuous; stigma simple; ovules numerous, amphitropal. Pericarp with 2 or 4, or many cells, either a capsule with double dissepiment parallel with the valves, or a berry with the placentæ adhering to the dissepiment. Seeds numerous; embryo straight or curved, often out of the centre, lying in fleshy albumen; radicle near the hilum.—Herbaceous plants and shrubs. Leaves alternate undivided or lobed, sometimes collateral; the floral ones sometimes double, and placed near each other. Inflorescence variable often out of the axil; the pedicels without bracts.—The anthers of *Solanum* open by pores. *Nicotiana multivalvis* has many cells in the capsule as has *Lycopersicum. Nicandra* is 5-celled; *Datura* 4-celled. Lindley.

In regard to these anomalies, it may be remarked, in passing, that I do not suppose it is the intention of the author to imply that *Nicotiana multivalvis* and *Lycopersicum* have, in their normal state, a many-carpelled ovary, but simply to state that, in the cultivated forms, in which they are now always seen, these changes, the effect of culture, have become nearly permanent, at all events so constant that, out of a dozen flowers examined, probably not more than 1 or 2 will be found with fewer than 6 or 8 cells. I infer this to be his meaning because the result of my examinations has led to the conclusion that, in its normal state, *Lycopersicum* is, like the bulk of the order, dicarpellary. *Nicotiana multivalvis* I have never seen. *Nicandra* is said to have a 5-celled capsule, perhaps a typographical error, as Gærtner, Endlicher, Meisner, and Walpers all assign to it a 3–4-celled capsule; but whether it is so or not, I am in this case, as much as in the former, disposed to doubt in this genus, in its normal state, the presence of more than 2 carpels. As my specimens of *Nicandra* are not however very good, I cannot venture further than merely to express a doubt of the correctness of former observation, simply with a view to calling attention to this point which, I think, well merits careful investigation. I urge this partly as the result of direct examination of the ovary and of dried fruit in different stages of advancement, partly from what I have observed in *Datura*, also said to be 4-celled, but which has certainly a dicarpellary ovary, as the accompanying sections, taken from the same ovary, clearly prove. The supplementary partitions, being formed from thickening of the parietes, not derived from additional carpels combining to form a 4-carpellary fruit, are spurious. As regards *Datura*, I speak with certainity as to its fruit being dicarpellary. Of *Nicandra*, though less certain, I still feel but little doubt of such being the case there also. And with respect to *Lycopersicum*, if there be actually plurality of carpels, it is as much a monstrosity in that genus, as 12 fingers and toes are in the human hands and feet. But while I thus feel almost certain that in these three genera the dicarpellary structure of the ovary is the normal form, I think that the variations observed in their placentæ will be found to furnish interesting matter for the investigation of the philosophical Botanist. That of *Nicandra* is certainly very curious.

Affinities. On this head some differences of opinion exist but not great. All Botanists agree in thinking that, though so nearly related to *Scrophulariaceæ* that at some points it seems almost impossible to draw the line between the 2 orders, yet that, as a whole, they are amply distinct; so much so indeed that Endlicher, Meisner, and Lindley, all agree in placing the two orders in different groups or alliances, the one primarily characterised by having *regular*, the other *irregular* flowers. The orders, however, associated with *Scrophulariaceæ* seem to accord better with its characters, than those among which *Solanaceæ* is arranged do with its.

Lindley adds the Olives and *Asclepiadeæ* to his alliance, and expresses as his opinion, that "the most immediate affinity of Nightshades *(Solaneæ)* seems to be with Olivewort*s (Oleaceæ)* and Bindweeds *(Convolvulaceæ)*; to the latter of which their numerous twining species bring them very close, while the first division of the order stands on the very threshold of *Oleaceæ*. Compare, for instance, *Syringa* with *Cestrum*."

Regarding this view of their affinities I can offer no opinion of my own, as the poverty of my Herbarium does not permit me to make the comparison here called for; but it certainly seems rather odd that this view has not suggested itself to any other Botanist. That, however, does not militate in the slightest degree against the correctness of Lindley's views. I have, however, compared the characters of the two genera, and also Gærtner's figures of them, and, after allowing for an error in the last, confess that, so far as such evidence enables me to advance, I can trace no relationship between these orders any more than the Botanists whose writings on the subject I have consulted; neither does the relationship between this order and *Asclepiadeæ* strike me. But while I would thus exclude these two orders from the Solanal group, I now fully coincide with the accomplished author in considering that *Solanaceæ* and *Scrophulariaceæ* ought not to stand in the same alliance; not however "because of the manifest tendency of the former to lose the dicarpellary structure, as seen in *Nicandra*, *Lycopersicum*, and *Nicotianas*," for that I conceive remains to be established in all those genera; but because of the manifest tendency to regularity and symmetry of the former, and to irregularity of the latter. Such a tendency (to multiplication of carpels) certainly does not exist in *Datura*, and my examination of *Nicandra* does not confirm the accuracy of Gærtner's figure which I find incorrect, as representing a perfect 4-carpellary structure which does not exist in the specimens of that plant I examined. My reason for adopting Dr. Lindley's view is based on the regular symmetrical flowers of the one, and the irregular unsymmetrical ones of the other. On this I place greater reliance than on characters taken from either the ovary or embryo, though I am aware there is a tendency in several *Scrophulariaceæ* to become regular, but in all such cases except, perhaps, the *Verbasicums*, with little disposition to become symmetrical.

The immediate affinities then of this order are, on the one side, with *Scrophulariaceæ*, and on the other with *Hydroleaceæ*.

Geographical Distribution. This order has a wide range, extending from the tropics through both the temperate zones, but is most abundant in the warmer regions of the Earth. In America they are very abundant, especially species of the genera *Solanum* and *Physalis*, the number of whose species greatly exceed the aggregate of all the others put together. In India, though *Solaneæ* are common as respects individuals, they are few as regards species, but have a wide range, every part of the country being more or less thickly studed with them, from Cape Comorin to the Himalayas, and in the Peninsula from the coast to the tops of the highest mountains. They equally inhabit the humid low-grounds and the more elevated parched ones. On the plains they are usually herbs or small shrubs, on the mountains several species of *Solanum* become small trees.

Properties and Uses. Regarding these much might be said, as many exotic species merit extended notice on account of both their good and bad qualities; but I shall principally confine my remarks to the Indian species, a few only of which are in use, and those not generally possessed of very energetic qualities. Generally the whole family may be set down as very suspicious, so many of them being known to be endowed with virulently narcotic and acrid properties, and so few in which those of an opposite character are found. Among the latter we have in this country the common Brinjal, *Solanum Melongena*, which, under cultivation, has become a common and, among the natives, a much prized esculent; but which is unfit for nse until cooked, the heat in this as in many other cases destroying the inherent bad qualities of the fruit. The Winter cherry or Cape gooseberry, *Physalis Peruviana*, now a perfect weed on the Neilgherries and other cool climates, is another esculent, but whose ripe fruit may be safely eaten fresh from the bush; and lastly the Tomata or Love-apple, *Lycopersicum esculentum*—so called "in allusion to the supposed power they possess of exciting the tender feelings"—

in general use as an ingredient in sauces, soups, stews, &c. This about closes the list of our really useful indigenous esculent fruits obtained from this family. By far the most valuable contribution of this remarkable family to the wants of man is the Potatoe, *Solanum tuberosum.* This tuber is not, properly speaking, the root but an under-ground stem, the acrid properties of which are in a great measure dissipated by the blanching it suffers through exclusion from light, and what little remains is removed during the process of cooking.

That this is the cause of its freedom from the noxious qualities of the tribe seems proved by the fact, that an extract from the leaves is a powerful narcotic, akin to Belladonna, and is said to be particularly useful in relieving the pain of Chronic Rheumatism, and painful affections of the stomach and uterus. Of the esculents, if such indeed it may be called, we have still another genus to mention, rather a pungent one, by the way, namely the Chilly, *Capsicum;* several of whose species are employed as condiments. I have said above "really useful esculents," for in addition to those named the fruit of several other species of *Solanum* are more or less used as such by the poorer classes of natives, but none are held in any considerable esteem except those first named. Among the poisonous species, of which this family furnishes so long a catalogue, those of India do not hold a prominent place, either as regards number or virulence. Out of all our long list of *Solanums*, not one approaches in poisonous energy to the English *Solanum Dulcamara*, still less to the Belladonna and Henbane. Those most esteemed for their energy, *S. trilobum* and *S. indicum*, are prescribed in various forms as expectorants in the treatment of pectoral diseases. The Daturas, of which the Indian flora furnishes 6 species, are more active and dangerous agents, but may still be used with perfect safety in the treatment of disease, if administered with caution. A story is told to the effect that in former times, the Scots mixed Belladonna juice in the food and drink with which they were compelled to supply the Danes, and during the general intoxication and somnolence which ensued, cut off nearly the whole of their army. In India tricks similar in kind are almost daily played off on the unwary with the seed and roots of different species of *Datura.*

These drugs are reduced to fine powder, mixed with flour and made into bread, sweetmeats, &c. Shortly after the medicated repast, drowsiness and deep sleep supervene, during which not seldom the sufferer is robbed of every thing, and ample time allowed for the robbers to escape. Occasionally the dose happens to be too strong, and death ensues. These facts, which are well known in India, clearly point out these plants as narcotics of great power, and probably better fitted to induce sleep, in cases of extreme watchfulness, than either Opium or Henbane *(Hyoscyamus).* Of the South American species, some are highly esteemed as febrifuges, the *Solanum pesudoquina* being so powerful in that way that the Brazilians will scarcely believe it is not the true Quinine.

The narcotic qualities, so predominant in this order, are stated by Endlicher to depend on a narcotic alkaloid joined with an acrid matter, varying in its proportions in different species; hence in some acrimony predominates; in many bitter extractive abounds, and some even possess æthereo-oily balsamic principles. I am unable to say whether, under this last term, he alludes to the fascinating and so generally esteemed properties of Tobacco, that being an almost universal favourite with all tribes and classes of men. When one thinks how intensely energetic the action of that vegetable is on the human frame, when taken into the intestinal canal, it certainly does seem strange that, inhaled as smoke into the fauces, or applied as snuff to the nostrils, it should be so much admired and extensively used. But such is the case and, in spite of all that has been said and done by statesman, moralists, divines, and physicians, to bring it into disgrace, it still holds its place in public estimation.

This may, perhaps, be partly accounted for by the fact, that its vituperators have generally been either men whose peculiar idiocyncrasies prevented their partaking of the enjoyment others derived from its use, or, on the other hand, those who had abused the privilege and injured their health by excess. The testimony of such witnesses can never be admitted as trust-worthy so mankind have gone on smoking and snuffing, notwithstanding all the abuse that has been heaped on the "weed," and, it is my belief, will continue to do so to the end of time, unless, perhaps, statesmen, forgetting the lessons of experience, put it out of fashion by overwhelming it under prohibitory duties, to the manifest injury of the state exchequer, and the banishment

of the peace and quiet of many good men who, being now contented to puff away their cares in the fragrant fumes of Tobacco, might become agitators for want of some better and more innocent occupation, and then become as bad and troublesome subjects as they are now good and amiable men.

Remarks on Genera and Species.—On this subject I have little to say. As regards genera, there is perhaps no family in the Indian flora, of the same extent, in which the genera are more easily distinguished; in fact they can scarcely be mistaken. As regards species, the case is different; they are most difficult, owing I suspect, to the merest variations having, in many cases been, I presume from the badness of the specimens, described as species. Professor Nees, when preparing his monograph, was more favourably situated, and has thereby been enabled to reduce a vast number of bad species which previously loaded our flora, to the great inconvenience of those who attempted their investigation. Now that the difficulty is removed by his excellent memoir, the species are generally more easily made out.

In plate 166, I have represented one of the many varieties of *Solanum Melongena*, selected for the purpose, on account of the small size of the leaves by which I am enabled to give a good figure within the limited space I have to devote to the species. The general form is much the same but the actual size different, a luxuriant plant furnishing leaves large enough to fill the whole paper. In the supplementary plate I have given analyses of six genera of the order, in all of which particular attention has been paid to the ovary. From these we learn that this is normally, a truly dicarpellary order; and that the occasions, on which more are present, are owing to excessive luxuriance caused by cultivation. Too much stress is, I fear, occasionally laid on these abnormal productions, and inferences drawn from them but too often more ingenious than philosophical.

EXPLANATION OF PLATE 166.

1. *Solanum melongena.* β insanum (Nees), flowering branch, natural size.
2. Detached flower, side view.
3. The same seen from above.
4. Corolla split open, stamens in situ.
5. Detached stamens.
6. Transverse section of an anther.
7. Calyx and ovary.
8. Ovary detached.
9. Cut transversely.
10. Longitudinally.
11. A fruit nearly full-grown.
12. Cut transversely.
13. A mature seed.
14. Cut longitudinally, embryo in situ.
15. Cut transversely.
16. Embryo detached.
17. Upper and under surfaces of the leaves. All more or less magnified.

EXPLANATION OF PLATE 166–b.

I. *Datura fastuosa* (Miller). The 3 sections of the ovary of this figure are all taken from one ovarium, showing that two of the apparent 4 cells of the lower section are spurious.

II. Nicotiana Tabacum (Linn). The sections of the ovary are, as in the preceding, all taken from the same ovarium.

III. *Lycium Indicum* (R. W. Icon. L. Europæum?) The plant from which this figure is taken is a native of Scinde and upper India. It is probably only a variety of L. Europæum, but seemed to me different when I named it as above.

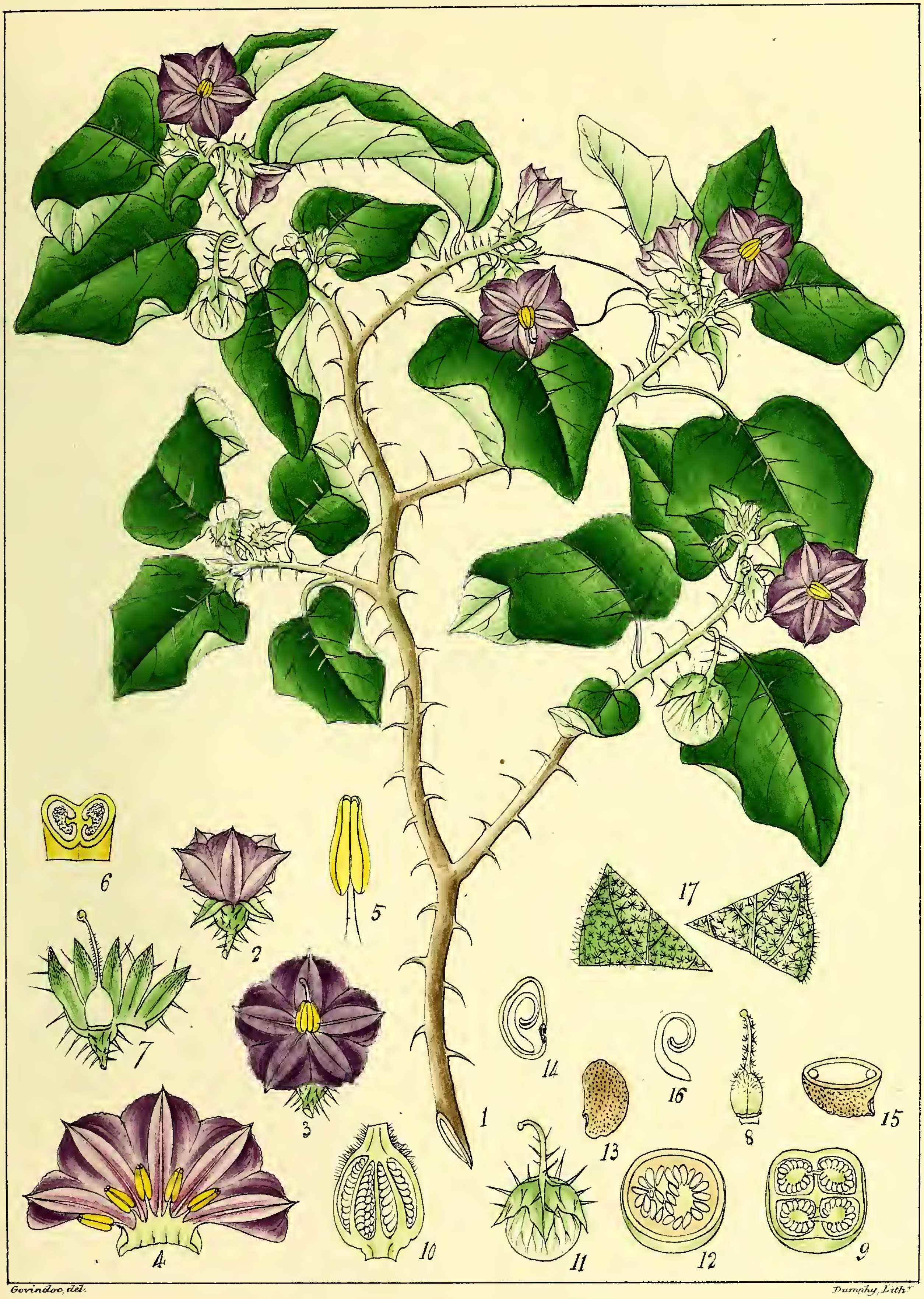
IV. *Capsicum fastigiatum* (Blume). This species is readily recognized by its capsules growing erect, not pendulous, like the rest of the Indian ones.

V. *Lycopersicum esculentum* (Miller). The sections of the fruit were taken from two half-grown berries picked off the same branch, one with two the other with 3 carpels. There was none with more on that plant, but I have seen them with several.

VI. *Physalis angulata* (Linn). A common plant in waste places.

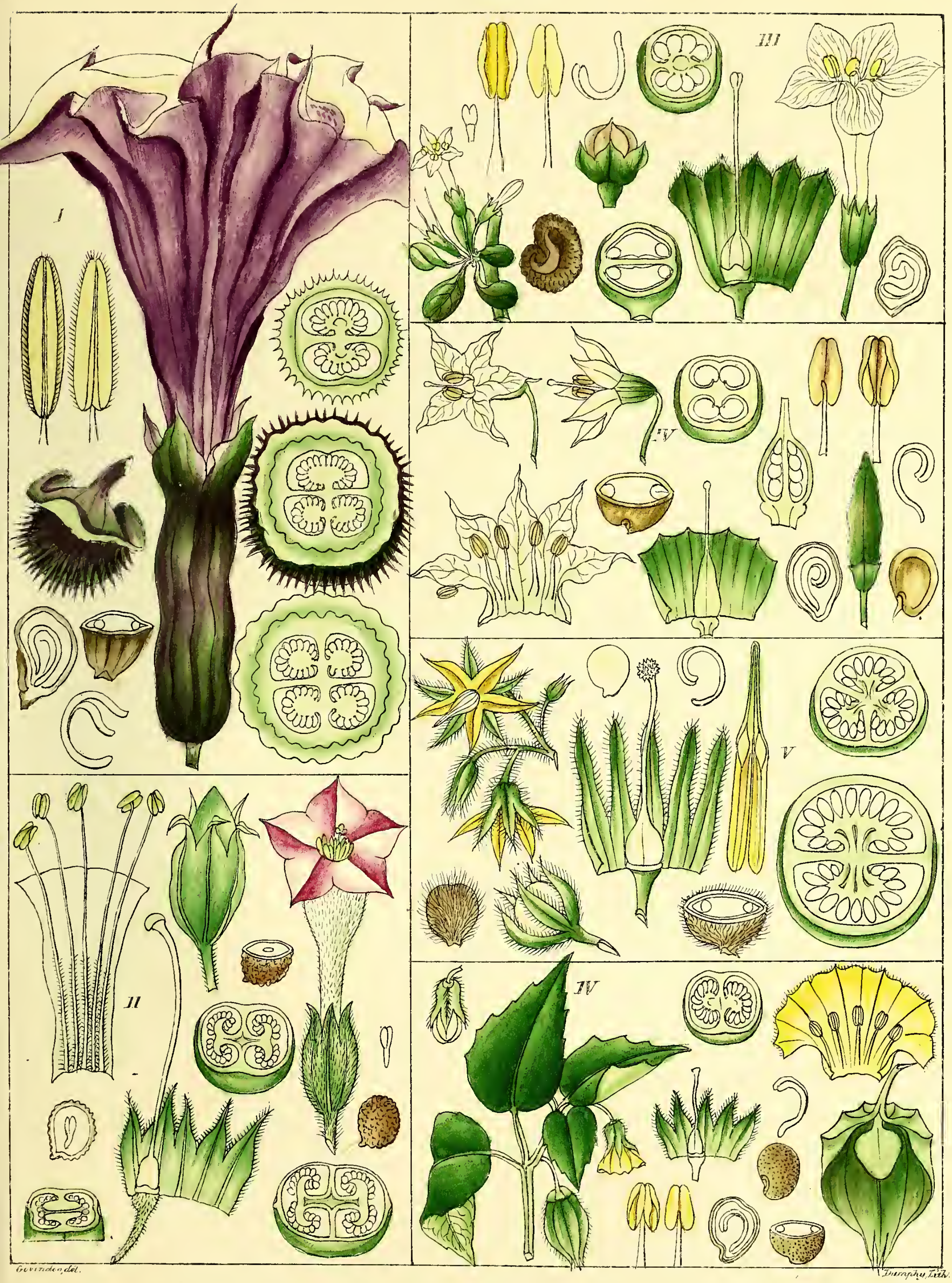
CXVI.—HYDROLEACEÆ.

The separate existence of this small order was first indicated by Mr. Brown, in his prodromus, but merely to the extent of remarking that several genera, at that time referred to *Convolvulaceæ*, did not properly belong to the order, and ought therefore to be removed. This opinion he afterwards repeated in his remarks on the Congo collection. Since that time the order has, until very recently, been generally adopted by Botanists. The same most accurate Botanist indicated in the same work (Prod. Flor. Nov. Holland.) another order *(Hydrophyllaceæ)*, as distinct from *Borragineæ*, with which its genera had been associated, and allied to *Polemoneaceæ*.



Govindoo, del. Dunphy, Lith.

SOLANUM MELONGENA (LINN)



Govindoo, del. Dumphy, Lith.

I. DATURA. II. NICOTIANA. III. LYCIUM. IV. CAPSICUM. V. LYCOPERSICUM.
VI. PHYSALIS.

HYDROLEA ZEYLANICA (VAHL.)

This order has also been generally adopted by Botanists. Such was the state of Botanical opinion regarding these two orders until the publication of the 9th Vol. of DC's. Prod., when Alph. DC., following a remark of Lindley, to the effect that the two orders were nearly related, instituted a closer comparison than, it would appear, had previously been made, and arrived at the conclusion that the two orders were scarcely sufficiently distinct. The opinion previously expressed by Lindley being thus strengthened, he has in his last edition (The Vegetable Kingdom) combined them. To this verdict M. Choisy demurs, and still upholds the integrity of the present order, mainly, on the ground that in this order the ovary is 2-celled with axile plaentæ and numerous ovules; in that, 1-celled with parietal placentæ and few ovules. On the merits of this question I can offer no opinion, as I only know one species of the two orders, and that being the only one indigenous to India I adopt the old order as its characters coincide with those of our only species, leaving American Botanists, who are more interested in the matter, to adjudicate between the opposite opinions. The following, with slight modification, is Choisy's

Character of the Order. Calyx usually 5-parted, lobes equal, often spathulately dilated at the apex, persistent. Corolla monopetalous, usually campanulate, 5-lobed. Stamens inserted on the corolla, alternate with its lobes, incluse or exserted. Ovary two-celled, placentæ axile, covered with numerous minute amphitropal ovules. Styles two; stigmata thickened or capitate. Carpels 2-celled, 2-valved, dehiscence marginal bearing on each side a spongy placenta. Seeds sessile on the placentæ, very numerous; albumen fleshy, embryo straight. Herbaceous annuals: stems straight or diffuse, glabrous, pubescent or hispid, rarely exceeding two feet in length. Leaves simple, alternate, entire or dentate, often petioled. Flowers corymbose or spicate, sometimes scorpioid.

Affinities. The genera of this order were formerly united with *Convolvulaceæ*, but very improperly, on account of the axile placentation and numerous seed. Judging from the only Indian representative, it certainly, as suggested by Choisy, is very nearly allied to "*Scophulariaceæ*, but more especially to *Solanaceæ*." Lindley places them in his Cortusal alliance along with *Plumbagineæ*, *Plantagineæ*, *Primulaceæ*, and *Myrsineæ*. So far as we can learn from *Hydrolea zeylanica* not a near relationship.

Geographical Distribution. All the species, except the one here given, are of American origin. Our species is a marshy plant, growing in rice fields and low wet ground, flowering during the latter months of the year.

Properties and Uses. Little is known on this head. The leaves are bitter and, in those parts of the country where the plant abounds, they are beaten into a pulp and applied as a poultice to foul ill-conditioned ulcers in which maggots have begun to breed, and are said to be an effective means of cleansing the one and destroying the other.

EXPLANATION OF PLATE 167.

1. *Hydrolea zeylanica.* Flowering branch, natural size.
2. An unopened flower-bud.
3. An expanded flower.
4. Corolla split open, stamens in situ.
5. A detached lobe of the corolla with a stamen attached.
6. Anthers, back and front views.
7. Ovary and calyx.
8. Detached ovary.
9. 10. Ovary cut vertically and transversely.
11. A full-grown fruit.
12. Cut transversely.
13. Capsule dehiscing.
14. A detached seed.
15. Cut longitudinally, embryo in situ.
16. Detached embryo.

CXVII.—CONVOLVULACEÆ.

Few orders have proved more troublesome to Botanists than this large and very natural family of plants, while its numerous and beautiful species have made it a great favourite. The great difficulty which has always attended the investigation of its species has originated, not so much in their discrimination as in the correct limitation of the genera to which they require to be referred, a point on which, for a long time, no two Botanists could agree. M. Choisy in his memoirs on the order (Mem. Soc. Phys. Genev. Vol. vi.), and subsequently in his monograph in De Candolle's prodromus, has done something towards removing that obstacle to our more intimate acquaintance with the species, but he has still left much for future Botanists to accomplish. Of this he himself seems well aware as he "recommends and exhorts the reader not readily to relinquish the work of investigating a species of *Convolvulaceæ*, nor too readily to cut the Gordian Knot by creating new species and proposing new names, which may render the Synonomy, already very obscure, still more so. If the plant under examination, says he, is not found among the *Ipomœas*, then try among the *Argyreias*, then among the *Jacquemontias*, and it will perhaps be easier." Had he not felt conscious of the imperfections of his work, he could scarcely have deemed it necessary to introduce such an exhortation. The fact seems to be, as I have (to a limited extent) ascertained by the examination of authentic specimens of a number of his species, that he had constructed his generic characters from single species and has added on others, without sufficient examination to ascertain whether they corresponded, and hence has resulted, on numerous occasions, inextricable confusion, unless his own specimens be re-examined to verify his generic determinations. His generic characters, if sufficient for the purpose, are simple enough and for the most part, with the aid of a microscope of moderate power, easily made out, but the species referred to them have not been generally subjected to that test. The question then occurs, are the characters sufficient? This I will not attempt to answer, but whether or not, I feel quite certain the most has not been made of them; they are artificial, based on the ovary, and will be found useful in practice, but I am convinced, from my own examinations, that that organ has rarely been examined. I have felt it necessary to introduce these remarks to warn the Indian Botanist who undertakes, with the aid of Choisy's monograph, to name his species of *Convolvulaceæ*, to expect many difficulties and some disappointments. On the correctness or otherwise of the principles adopted I offer no opinion, contenting myself with the results as shown by their fitness for practical application. As applied on the large scale of the whole order, they will probably be found defective; as limited to the Indian flora, I have, with some slight corrections, found them so useful that I now regret not having re-examined, with that special object in view, all those named in the subjoined conspectus, so as to have enabled me, if not to recast the whole, at all events to indicate those which have been referred to wrong genera. The order is one of great extent, and also in very many instances of great beauty. Lindley gives 43 as the number of its genera, and 660 species. Additions have been since made to the species, but it is my belief the genera, as now constructed, must be reduced rather than augmented, but at the same time it is my impression that when constructed on more philosophical principles, the number will be increased beyond the present standard.

Character of the Order. Calyx 5-sepaled: sepals persistent, equal or unequal, arranged in a single, double, or triple series, often enlarging with the fruit. Corolla monopetalous, hypogynous, regular, with the limb, 5-plaited or 5-lobed, twisted in æstivation. Stamens 5, alternate with the lobes of the corolla; filaments often unequal, dilated at the base; anther long, adnate, sagittate, 2-celled; pollen granular, spherical or annular. Nectary annular, embracing the base of the ovary of most species. Ovary usually simple, 2–4-celled, rarely partially, or altogether, one-celled, occasionally double or qaudruple; each cell with one or two erect ovules; style one, entire, more or less deeply bifid, rarely double; stigma acute, flattened, or globose, terminating each branch of the style, hence, 2-lobed on a single style. Fruit capsular, variously dehiscing, or dry-baccate, indehiscent, 1–4-celled; cells 1–2-seeded; dehiscence of the capsules valvate. Seed subtriangular, rounded on the back, glabrous or villous; testa usually hard;

albumen mucilaginous; cotyledons foliaceous, corrugated, radicle incurved, inferior.—Herbs, undershrubs, shrubs or trees, stems straight, procumbent or twining, parasitical and leafless in *Cuscuta*. Leaves alternate, simple, entire or lobed, sessile or petioled. Flowers one or several on axillary peduncles formering cymes, racemes, umbels or corymbs or often capitula; pedicels often bibracteate; bracts sometimes enwrapping the flowers. Roots simple, or tuberous. Pubescence often shining and beautiful. Choisy.

Affinities. This order, as placed here, seems to stand in its most natural position; the transition from *Solanaceæ* through *Hydrolea* is simple and easy, on the one side, while its passage, into *Borragineæ* through *Cordiaceæ* and *Ehretiaceæ*, is equally uninterrupted on the other. These again (Borragineæ) pass by an equally easy transition through *Verbenaceæ* into *Labiatæ*. This however is not the view Lindley takes; he places *Asclepiadeæ* and *Cordiaceæ* next each other, between *Solanaceæ* and *Convolvulaceæ; Oleaceæ* next *Solanaceæ*, and closes his sub-albuminous Solanal Alliance with *Polemoniaceæ*, a very albuminous order. As a whole, his Solanal Alliance appears to me a very heterogeneous one and far from natural, but that is perhaps matter of opinion.

Geographical Distribution. This large order greatly preponderates towards the equator, its species becoming fewer as the latitude rises until they cease altogether on the confines of the frigid zones. Three species are natives of England, besides two or three species of Cuscuta. In America they are more numerous than in Asia, but are generally diffused over all the warmer parts of the globe.

Properties and Uses. The roots of a number of the species of this order abound in a resinous milky juice, strongly purgative, to which we are indebted for the active cathartic properties of Jalap and Scammony. Of the numerous Indian species of the order but few are employed medicinally and only one, so far as I am aware, as a purgative, namely, the *Ipomea Turpethum*. I never myself prescribed it, but have been often told that it possesses considerable activity, and acts without griping or uneasiness. The leaves of *Argyreia speciosa* are said by the natives to act as a discutient, and relieve the pain of boils and cutaneous inflammations. The only case in which I have seen it used it did more, it acted as a visicatory and entirely removed the cuticle, thereby much augmenting the sufferings of the poor patient, who was affected with anurism of the arteria innominata, then projecting above the edge of the clavicle.

The sweet potatoe, *Batatus esculentus*, is a member of this order, and a very useful one, for, being of easy cultivation and supplying much nourishment, it is in general use as an esculent.

Remarks on Genera and Species. In my introductory remarks I adverted to Choisy's want of care in determining the genera to which his species belonged. In a letter of mine, published some years ago in Hooker's Botanical Journal (Vol. 3, p. 199), I stated that his *Argyreia cuneata* had a 4-celled ovary, and was therefore, according to his definition, of the genus, a species of *Rivea;* to which the author replies, in De Candolle's Prodromus (p. 827 under *Rivea):* "Huic (Argyreia cuneata) Cl. Wight tribuit ovarium 4-loculare quod non adhuc recog noscere potui."

This unexpected remark induced me not merely to re-examine that species with much care, in both the recent and dry state, but to extend my examination to many other species of his genus *Argyreia*. The result proved almost as unexpected as the remark which led to the inquiry, and induced me to publish in the Calcutta Journal of Natural History a brief summary of the conclusions at which I arrived. As that Periodical is, I believe, in the hands of but few of the readers of this work, I shall republish an extract from that paper, which will, I trust, prove that I have not been premature in arriving at the conclusions stated above.

Between the genera *Porana* and *Breweria*, there exists some unexplained if not inexplicable confusion. On comparing the characters of *Porana volubilis* and *P. racemosa*, I found they did not correspond, but on comparing those of *P. volubilis* with *Breweria Roxburghii* the exact similarity was immediately obvious, leaving no doubt, in my mind, of the generic

identity of these two plants. This fact, it seems probable, will cause some confusion, since it now appears that *Porana volubilis*, the type of the genus *Porana*, is generically identical with *Breweria Roxburghii*, and I presume with all the other species of that genus, but is not identical with all or perhaps any of the associated species of *Porana*. This is a point which it seems necessary to examine carefully, and which, now that it is suggested, will, I trust, engage the attention of some Botanist having adequate materials to enable him finally to dispose of a question that may lead to the breaking up of several genera. Among the examples given in the supplementary plate will be found, for more easy comparison, analyses of *Porana volubilis*, *Breweria Roxburghii*, and *Porana racemosa*. Of the latter, 2 sections of the ovary are given, one transverse, exhibiting the normal form, 2-celled, each 1-ovuled; the other longitudinal, showing one further advanced with a solitary erect ovule; the other having already aborted as the mature fruit is one-seeded.

"CONVOLVULACEÆ.

Rivea, *Argyreia*, *and Lettsomia.*

"M. Choisy, in his Memoir on Indian Convolvulaceæ, in taking up Loureiro's genus ARGYREIA, has changed its character so essentially, that every one of Loureiro's genuine species must now be excluded. I say *genuine*, because if Choisy is correct in referring *Argyreia festiva*, Wall., to *A. acuta*, Lour., which I doubt, then that is not a true species of his genus, which, as defined by himself, has a 4-celled ovary, while *A. festiva* has it 2-celled.

"Loureiro's character of the fruit of Argyreia is 'bacca subrotunda exsucca 4-*locularis*;' Choisy's '*ovarium* 2-*loculare* 4-spermum.' If the berries in Loureiro's plants have four cells, it is obvious the ovary must have had at least an equal nnmber: hence, in assigning a 2-celled ovary to Argyreia, Choisy has altogether suppressed the original genus, and set up a most distinct one in its place, while at the same time he has added to the confusion by placing in his new genus, numerous species with 4-celled ovaries and fruit. In fact, nearly the whole genus, as it now stands in De Candolle's Prodromus, will, I apprehend, be found not to come within his generic character.

"It is a curious fact, that Roxburgh fell into a similar error in regard to his genus *Lettsomia*, which, according to his definition, has 2-celled ovaries, while nearly all his species have them 4-celled. When both he and Loureiro wrote, the same importance was not attached to that point of structure that M. Choisy has shown it deserved, and their error is easily traced to too rapid generalization. Loureiro must have examined a species with a 4-celled fruit, and took it for granted all the others had the same structure. Roxburgh on the other hand, when drawing up the character of his genus Lettsomia, seems to have had a species before him with a 2-celled ovary, and assumed that all the other species with baccate fruit had likewise only two cells. He consequently associated under that character many species with 4-celled ovaries, and only two or three having them 2-celled. M. Choisy, in the course of his examinations, met with some species having four cells, others having two cells: of the former he has constituted the genus Rivea, of the latter his genus Argyreia. But falling into the same error as Loureiro and Roxburgh, he has generalized where he should have dissected, and has thereby been induced to bring together, under his essential generic character, 'ovarium 2-loculare,' numerous species having ovarium 4-loculare.

"With a view to the correction of these blunders, with the least amount of inconvenience to the science, I propose retaining all the three genera, which can be very well done by merely slightly altering the character of Rivea, and leaving the other two as defined by their original founders. For example, Choisy gives to Rivea a capitate or lamelliform 2-lobed stigma and 4-celled ovary: I propose substituting the word *linear* for *capitate*, and referring all Convolvulaceous plants having indehiscent fruit, a 4-celled ovary and linear, cylindrical, or lamelliform stigmas, to Rivea; those with 4-celled ovaries and capitate, 2-lobed stigmas, to Argyreia; and lastly, those having 2-celled ovaries and capitate, 2-lobed stigmas, to Lettsomia. With this modification, Rivea stands in exactly the same relationship to Argyreia, that Convolvulus does to Ipomœa, while Lettsomia forms the transition from Argyreia to Ipomœa, having the indehiscent fruit of the one, and the 2-celled ovaries of the other.

"The characters of these three genera will then stand thus:—

"*Rivea.*—Fruit indehiscent. Ovary 4-celled. Stigmas 2, linear, cylindrical or lamellate.

"*Argyreia.*—Fruit indehiscent. Ovary 4-celled. Stigmas capitately 2-lobed.

"*Lettsomia.*—Fruit indehiscent. Ovary 2-celled. Cells 2-seeded. Stigma capitately 2-lobed.

"Thus limited, the genera *Maripa*, *Legendrea*, *Marcellia*, *Blinkworthia ? Humbertia*, and *Moorcroftia*, will probably all be absorbed by *Lettsomia*, along with some of the species now referred to Argyreia, such as *A. acuta* (Ch.), *A. aggregata* (Ch.), *A. festiva* (Wall.), *A. sestosa* (Ch.), *A. elliptica* (Ch.). Our genera will then possess precision of outline very favourable for the determination of their species: as they now stand, that is wanting, and determination is consequently most difficult, whence we now find species of Argyreia, as here limited, referred to Rivea, Argyreia, and even to Ipomœa."

Having premised these suggestions for the reconstruction of these genera, I shall conclude my remarks on this family by republishing, from the Madras Journal of Science, a "Clavis Analytica" of the Peninsular genera and species, which I often found of infinite service, prior to the appearance of De Candolle's 9th volume, and which I still find a valuable adjunct to the larger work in the determination of difficult species, and at all times more convenient for ready reference. In the suplementary plate I have introduced analyses of as many of the genera, as I could make it accommodate.

Choisy's tribe *Cuscuteæ* is considered by many Botanists, and not without reason, a distinct order. It differs widely in habit, being parasitical and leafless, and in having, moreover, a series of scales within the tube of the corolla which, it is presumed, may be viewed as an inner row of stamens. On this point I feel very doubtful, as we find similar appendages in many other plants where no such origin is suspected, and moreover because I find them wanting, in one I published in my Icones, under the name of *Cuscuta arabica.* The habit is dissimilar, the embryo is very different, and the scales are wanting in *Convolvulaceæ*, all legitimate grounds for viewing them as distinct; but still, as they have always been united, I feel disposed for the present to retain them here.

CLAVIS ANALYTICA of the Convolvulaceæ of the Peninsula of India, by George Walker-Arnott, Esq. a.m., f.l.s. & r.s. Edin.; *communicated, with observations and figures,* by Dr. Wight.

TO THE EDITOR OF THE MADRAS JOURNAL OF LITERATURE AND SCIENCE.

Sir—The subjoined *Clavis Analytica* of the Peninsular *Convolvulaceæ* (prepared and communicated to me by G. Walker-Arnott, Esq.) I hope will prove as useful to your botanical readers as I have found it, in determining the species of that beautiful, but difficult, and hitherto ill-understood, family of plants. I may here premise, that I have met with one or two errors in the first two genera, two or three species of *Rivea* being referred to *Argyreia*, which, however, is of little consequence, as the precision of the generic characters will soon lead to their correction. It is proper to add, that these are not chargeable to Mr. Arnott, he having simply reduced, to a tabular form, the species according to M. Choisy's determination, adding a few new ones in my collection, not seen by that gentleman when elaborating his Memoir. Mr. A. thus writes

"As M. Choisy's Memoir on the Indian *Convolvulaceæ* is inaccessible (being printed in a foreign Society's transactions), I have got a loan of it from our friend Sir W. J. Hooker, and as *Convolvulaceæ* appears to be a favourite Order of yours, I shall here present you with a Clavis Analytica, adapted solely to the Peninsular species, which I have made out from his specific characters for my own use. You of course understand, that in the Clavis I reject all characters (good or bad) that are not essential to your making out the plant: it is possible, therefore, that ere this you may have got some new ones, in which case they, by the Clavis, may appear to coincide with, what they are really distinct from."

The letters, appended to the following generic names, show the successive steps of operation in examining a plant: that at end of first step, refers to the second, the second to the third, &c. The species, *Ipomea obscura*, has been selected as a favourable example, from its going through so many successive steps. These, when put together, form a very complete character:

Thus—"*a*, stems twining—*g*, capsules and sepals moderate sized or small—*m*, flowers not capitate—*p*, leaves cordate—*q*, leaves entire—*r*, flowers two or three—*u*, one- to three-flowered—*v*, leaves cordate acuminated, stems glabrous or softly villous. I. *obscura*."

As it appears not improbable that there are some additional genera, as well as species, not included in this Clavis, natives of the the Peninsula, I send along with it M. Choisy's own *Conspectus Generum*, published in the *Annales des Sciences Naturelles*, for September 1834, and leave you to determine on the propriety of reprinting it among your selections.

I remain, &c.

ROBERT WIGHT.

EXPLANATION OF PLATES.

Pharbitis A. C. D., ovar. 3-celled.
Ipomea A. C. D. F. G. H., sepals verticillate.
Batatas A. C.D.E., cor. campanulate, stamens included.
Quamoclit A. C. D. E., corol. infundibuliform, stamens exserted.
Rivea A. B., ovar. 4-celled.
Aniseia A. C. D. F. G. H., sepals inserted, some lower down than others.
Ipomea obscura.—a. g. m. p. q. r. u. v.—I. obscura.

CONVOLVULACEÆ.

Clavis of the Genera.

	Embryo, without cotyledons - - - - - -	15 CUSCUTA.
	——— with cotyledons. A.	
A	Fruit, a dry berry. B.	
	——— capsular. C.	
B	Ovarium, 4-celled, - - - - - - - - -	1 RIVEA.
	——— 2-celled, - - - - - - -	2 ARGYREIA.
C	Styles single, undivided. D.	
	———single and bifid, or 2 styles. K.	
D	Ovarium, 4-celled. E.	
	——— 3-celled, - - - - - - - - -	5 PHARBITIS.
	——— 2-celled. F.	
	——— 1-celled. I.	
E	Corolla infundibuliform: stamens exserted, - - - - - -	3 QUAMOCLIT.
	——— campanulata: stamens included, - - - -	4 BATATAS.
F	Stamens exserted, corolla infundibuliform, - - - - - -	6 CALONYCTION.
	——— included. G.	
G	Lobes of stigma, globose. H.	
	——— filiform or terete, - - - - - - -	8 CONVOLVULUS.
H	Sepals, verticillate, - - - - - - -	7 IPOMÆA.
	———inserted, some lower down than others, - - - - -	9 ANISEIA.
I	Lobes of stigma, flattened, ovate, - - - - - -	*10 HEWITTIA (W. & A.).
	——— globose, sepals enlarged after flowering, - - -	11 PORANA.
K	Styles 1. bifid: anthers included, - - - - - -	12 BREWERIA.
	——— 2. L.	
L	Styles, undivided: stigmas globose, anthers exserted, - - -	13 CRESSA.
	——— each bifid, - - - - - - -	14 EVOLVULUS.

Clavis of the Species.

1. RIVEA. *Ch.*

	Corolla inflated, cylindrical. - - - - - - -	1 R. tiliæfolia, ch.
	——— with limb spreading. *a*.	
a	Corolla hypocraterif., tube equal, narrow, peduncles 1-flowered. - -	2 R. hypocraterif, *Letts.*
	——— infundibulif., tube wider upwards, peduncles 3-flowered or with 2 lateral abortive ones. - - - - - - - -	3 R. bona-nox.

* 10 SHUTERIA *Ch.* (not W. & A.)

2. Argyreia. *Lour. Lettson. Roxb.*

	Stamens included. *a.*	
	——— protruded beyond the tube. *p.*	
a	Leaves tomentose, silky, or velvety on the under side. *b.*	
	——— villous, or pubescent, glabrous or hairy on the under side. *h.*	
b	Leaves cordate at the base. *c.*	
	——— elliptical, oblong, or lanceolate. *e.*	
c	Leaves softly tomentose and silky underneath; flowers somewhat umbelled. *d.*	
	——— harshly tomentose, underneath; flowers cymose, stems hairy, -	4 A. hirsuta (W & A.),
d	Stamens tomentose: bracteas oval, acuminated, waved, - - - -	5 A. speciosa.
	——— pubescent or glabrous; bracts lanceolate or linear, - - -	6 A. argentea.
e	Leaves glabrous on upper side. *f.*	
	——— clothed on upper side. *g.*	
f	Leaves roundish oblong, acute, - - - - - - - -	7 A. bracteata, Ch.
	——— lanceolate acuminated, - - - - - - - -	8 A. fulgens, Ch.
g	Leaves subacute, upper side strigosely hirsute, under sericeous tomentose, -	9 A. Leschenaultii, Ch.
	——— obtuse, both sides velvety, - - - - - -	10 A. pomacea, Ch.
h	Leaves cordate at the base. *i.*	
	———not cordate. *o.*	
i	Stem harshly hairy. *k.*	
	—— glabrous, or pubescent or villous. *m.*	
k	Flowers capitate, capitulum surrounded by bracteas, - - -	11 A. capitata.
	——— umbelliform, bracteas all mingled with flowers. *l.*	
l	Hairs reddish; sepals ovate, elliptical obtuse, - - - - -	12 A. Neilgherryana.
	Leaves underneath livid or glaucous, sepals linear lanceolate pointed, -	13 A. pilosa (W. & A.).
m	Exterior sepals equal to, or smaller than the others: leaves with a short broad sinus, - - - - - - - - - - - -	14 A. populifolia, Ch.
	——————— the largest and with margins revolute. *n.*	
n	Stem and leaves villous or softly pubescent, - - - - -	15 A. Roxburghii.
	——————— sprinkled with short adpressed pubescence, or glabrous, -	16 A. Malabarica.
o	Leaves obovate-cuneate, emarginate; peduncle 3–6-flowered, - -	17 A. cuneata.
	——— elliptical, ovate or obovate; panicle lax, corymbose, - -	18 A. elliptica.
p	Flowers capitate, leaves tomentose underneath, - - - - -	19 A. aggregata.
	——— corymbose or cymose. *q.*	
q	Stem and underside of leaves hirsute or strigose with adpressed hairs; peduncles a little longer than the petiole, - - - - - - - -	20 A. setosa.
	—— and leaves more or less pubescent; peduncles the length of the leaves,	21 A. cymosa.

3. Quamoclit. *Ch.*

Leaves entire, or angled, or 3-lobed, - - - - - -	22 Q. phœnicea.
—— pinnately cut, - - - - - - -	23 Q. vulgaris.

4. Batatas. *Rumph.* and *Choisy.*

	Leaves entire, angled or cleft. *a.*	
	—— quinate: stem twining, hirsute, - - - - - -	24 B. pentaphylla.
a	Sepals ovate lanceolate, a little unequal: stems usually prostrate; peduncles few-flowered, - - - - - - - - - -	25 B. edulis.
	—— roundish ovate, equal: stem twining glabrous: peduncles many-flowered,	26 B. paniculata.

5. Pharbitis. *Ch.*

Leaves entire; pedicels longer than the bracts, nearly as long as the sepals,	27 P. hispida.
—— 3-lobed or entire, pedicels usually shorter than the bracts, about $\frac{1}{4}$ of the length of the sepals, - - - - - - - - -	28 P. nil.

6. Calonyction. *Ch.*

Sepals equal, with an awl-like point; flowers, large, white, - - -	29 C. speciosum.
——————— flowers smaller, purplish, - - - - -	30 C. speciosum.
—— unequal, obtuse, or with a very short point, - - - - -	31 C. asperum.

7. Ipomæa. *Linn.*

	Stems not twining—*a*. —— twining—*g*. (§ Strophipomœa.)	
a	Stems creeping, and throwing out roots. —*b*. (§ Erpipomœa.) —— prostrate, not creeping—*f*. (§ Orthipomœa) leaves auricled at base: plants glabrous.	
b	Leaves sagittate, lanceolate, acute, - - - - - - -	32 I. reptans.
	——obtuse or emarginate—*c*.	
c	Glabrous; sepals wrinkled: flowers pretty large—*d*. more or less hirsute: sepals not wrinkled: flowers small—*e*.	
d	Leaves emarginate or 2-lobed, - - - - - - -	33 I. pescapræ.
	—— cordate, reniform, obtuse, - - - - - - -	34 I. rugosa.
e	Leaves reniform, obtuse, sinuately toothed: sepals ovate, rounded, ciliately torn,	35 I. reniformis.
	—— cordate, reniform, obtuse or emarginate, entire: sepals linear lanceolate, hairy, - - - - - - - - - -	36 I. venicifolia.
f	Leaves usually truncate or 3-toothed, - - - - -	37 I. tridentata.
	—— linear or linear lanceolate, - - - - - - -	38 I. filicaules.
g	Capsules and sepals large and showy—*h*. ———— moderate size or small—*m*.	
h	Leaves cordate, entire or sinuate—*i*. —— divided—*k*.	
i	Stem angled or winged: sepals unequal, densely pubescent, - - -	39 I. turpethum.
	—— terete: sepals equal, glabrous, - - - - - -	40 I. campanulata, Ch.
k	Leaves palmately 7-partite—*l*.	
	—— cordate, palmately 5-cleft or 5-angled, - - - - - -	41 I. vitifolia.
l	Lobes of leaves quite entire, - - - - - - -	42 I. tubrosa.
	——— sinuately toothed or pinnatifid, - - - - - -	43 I. dissecta.
m	Flowers capitate or aggregated—*n*. —— not capitate (in I. Wightii approximated)—*p*.	
n	Leaves palmate or lobed, peduncles as long as the leaf, - - -	44 I. pestigridis.
	—— cordate acuminated—*o*.	
o	Peduncles a little shorter than the petiole: flowers inclosed in a perfoliate involucre, - - - - - - - - - -	45 I. pileata.
	—— very short: flowers not involucred, - - - - -	46 I. sessiliflora, Roth.
p	Leaves cordate entirely or slightly lobed—*q*. —— digitate or pedate—*y*.	
q	Leaves entire—*r*. —— toothed, lobed—*w*.	
r	Flowers cymose or panicled—*s*. ——— 2—3, or umbelliform—*u*.	
s	Flowers racemosely panicled, leaves ovate oblong acuminated, cordate, 3–6-inches long, - - - - - - - - - -	47 I. racemosa, Roth.
	—— cymose: peduncles shorter than the leaves—*t*.	
t	Leaves ovate lanceolate, a little obtuse, mucronate (a doubtful plant), -	48 I. caliginosa.
	—— ovate, oblong, elongated, acute or acuminated, - - - -	49 I. cymosa.
u	Peduncles many-flowered, stem usually sprinkled with hairs, - -	50 I. sepearia.
	——— 1–3-flowered—*v*.	
v	Leaves cordate, acuminated: stem glabrous or softly villous, - -	51 I. obscura.
	—— cordate lanceolate with a blunt point; whole plant glabrous, - -	52 I. triantha.
w	Flowers yellow; style exserted: leaves glabrous, - - -	53 I. chrysoides.
	—— purple, style included: plant hairy: leaves tomentose underneath—*x*.	
x	Flowers cymose, distant, numerous, - - - - - -	54 I. pilosa.
	—— usually few on each peduncle, approximated, - - - -	55 I. Wightii.
y	Segments of leaves serrated, - - - - - - -	56 I. coptica.
	———— quite entire—*z*.	
z	Leaves tripartite, the segments trifid, - - - - - -	57 I. dasysperma.
	—— quinate—*&c*.	
&	Corolla infundibuliform; seeds villous, - - - - - -	58 I. pulchella.
	—— campanulate: seeds glabrous, - - - - - -	59 I. tuberculata.

Govindoo del. Dunphy Lith.

IPOMÆA RACEMOSA (ROTH)

8. Convolvulus. *L.*

Stem erect; peduncles longish, - - - - - - - 60 C. Rottlerianus, Ch.
—— twining—*a*.
a { Peduncles few, 1- to 3-flowered—*b*.
{ ———umbellately many-flowered, - - - - - - - 61 C. parviflorus.
b { Leaves sagittate, somewhat auricled; sepals obtuse, - - - 62 C. arvensis.
{ —— hastate, cordate, sinuately toothed: sepals ovate acuminated, - - 63 C. refescens, Ch.

9. Aniseia. *Ch.*

Stem hairy, twining, leaves oblong cordate, acuminated, longish petioled, - 64 A. calycina, Ch.
Stem glabrous or nearly so, rooting, leaves oblong, linear or cuneate, very shortly petioled, - - - - - - - - - 65 A. uniflora.

10. Hewitia. *W. & A. Shuteria, Ch. (not W. & A.)*

1. H. bicolor W. & A. (C. bicolor Vahl. & C. bracteatus Vahl.)

11. Porana. *Burm.*

1. P. paniculata Roxb. (perhaps not indigenous).

12. Breweria. *R. Br.*

Stem twining, leaves cordate ovate, acuminated, softly villous, petioled, 2 inches long, - - - - - - - - 66 B. Roxburghii, Ch.
Stem erect: leaves from oblong lanceolate, to oval and obtuse, almost glabrous, sub-sessile, 1½–2 lines long, - - - - - - 67 B. Evolvuloides.

13. Cressa. *L.*

1. C. indica, Retz.

14. Evolvulus. *Linn.*

Leaves almost sessile, hirsute on both sides, - - - - - 68 E. hirsutus, L.
——— shortly petioled (various as to shape and hairiness), - - 69 E. alsinoides, L.

15. Cuscuta.

Flowers racemose, 5-cleft: style 1. - - - - - 70 C. reflexa R.
Peduncles 3-flowered, flowers 4-cleft: styles 2, - - - - 71 C. hyalina, R.

1 Convol. gangeticus, Roxb. 2 Letts. uniflora, Roxb. 3 Letts. bona-nox, Roxb. 5 L. nervosa, R. 6 L. argentea, R. 8 Convol. fulgens, Wall. 10 Letts. pomacea. 11 Letts. strigosa, R. 14 A. bracteata, Wight in Comp. Bat. Mag. t. 3. 15 Ipom. multiflora, R. 16 C. malabaricus Linn. 19 Letts. aggregata, 20 L. setosa R. 21 L. oymosa, R. 22 Ipom. phœnicea, R. 23 Ip. Quamoclit, L. 24 C. hirsutus, Roxb. C. munitus, Wall. 25 Con. Batatas L. 26 C. paniculata, L. 27 C. purpureus, L. 28 Ip. cœrulea and cœrulescens, Con. nil Linn. 29 Ip. bona-nox, L. Ip. grandiflora, Roxb. 30 Ip. muricata, Linn. and Roxb. 31 C. asper., Wall. 32 Convol. repens, Roxb. 33 Ip. pescaprœ, C. bilobus R. 34 C. flagelliformis, Roxb. 35 C. renifis Roxb. 36 C. hirsutus, Wall. 38 C. medius, R. not Linn. 40 not Linn., the Linn. plant is Rivea tiliœfolia. 41 C. vitifol. R. 43 I. diversifolia, Ch. not Br. 46 C. sphœrocephalus R. 47 C. Kleinii, Sp. 47 I. staphylina R. and S. 49 C. blandus, R. and C. pentagonis, R. 51 C. obscurus, Willd. 52 perhaps a variety of Ip. cymosa. 53 C. dentatus R. C. flavus Willd. 54 C. pilosus, R. 55 C. Wightii, Wall. Pl. As. Rar. 57 C. pedetus, Roxb. 58 C. digitatus, R. 61 Retzia pilosa, Rott. 62 C. Malcomi, R. 64 Con. calycinus, R. 65 C. uniflorus, Burm. C. emarginatus, Vahl. C. Rheedii, Wall. 66 C. semidigynus. 67 Ip. parviflora, Rutt. 68 E. sericius, Wall. 69 E. angustifolius, R. These two probably the same species.

EXPLANATION OF PLATE 168.

1. *Ipomœa racemosa* (Roth, Choisy. J. staphylina Roem. and Sch. and Choisy formerly), flowering branch, natural size.
2. Detached corolla split open.
3. Calyx and ovary.
4. Ovary cut transversely, 2-celled with 2 ovules in each.
5. Mature capsule.
6. Capsule in state of dehiscence, 2-valved.

Obs. As this species rarely perfects its fruit those shown figs. 5 and 6 are taken from another species, none of the proper ones being procurable when the drawing was made.

EXPLANATION OF PLATE 168-b.

1. Rivea ornata (Choisy).
2. Argyreia pomacea (Ch.).
3. Lettsomia aggregata (Roxb. R. W. Ic.).
4. Convolvulus rufescens (Ch.).
5. Aniseia calycina (Ch.).
6. Hewetia bicolor (W. and A. *Shuteria* Ch. non W. and A.).

Obs. According to Choisy's character this genus has a 1-celled ovary; in my specimens they are two-celled with 2 ovules in each, an Ipomœa.?

7. Breweria Roxburghii (Ch.).
8. Porana volubilis (Burm.).
9. Porana racemosa (Roxb.).
10. Evolvulus alsinoides (Linn.).
11. Cressa Indica (Retz.).
12. Cuscuta hyalina (Roth? R. W. Ic.).

Obs. Roth describes his plant as having very small flowers, a little larger than a mustard seed, and the corolla 4-cleft. The flowers of my plant are certainly small but larger than his and are 5-lobed. Notwithstanding these discrepancies, I suspect we refer to the same plant, with this difference, that my drawing was made from fresh specimens, his description from dried ones. The figures of this plate however afford no criterion to judge of size as they are all magnified.

CXVIII.—BORRAGINEÆ.

This, as it now stands in De Candolle's Prodromus, is an order of great extent (upwards of 1000 species) and complexity, inasmuch as they (DC. father and son) having brought together as one what most other Botanists view as three distinct orders; namely *Cordiaceæ*, *Ehretiaceæ*, and *Borragineæ* proper. To this extreme grouping Lindley is strongly opposed, and even goes so far as to place the first in his Solanal Alliance, the other two in his Echial. Endlicher takes a different view. He retains *Cordiaceæ* as a distinct order, but unites *Ehretiaceæ* and *Borragineæ* under the Linnean family name of *Asperifoli*. Arnott, as will be seen by a reference to his syllabus, preserves all the three, but places them in a sequence. In this article I intend following De Candolle, but so far as the pictorial illustrations of the order can avail towards conveying a correct understanding of these different views, nothing will be wanting to enable every one, who may consult them, to judge for himself, as they will represent all the three orders or suborders, as each may think fit to consider them. This is De Candolle's

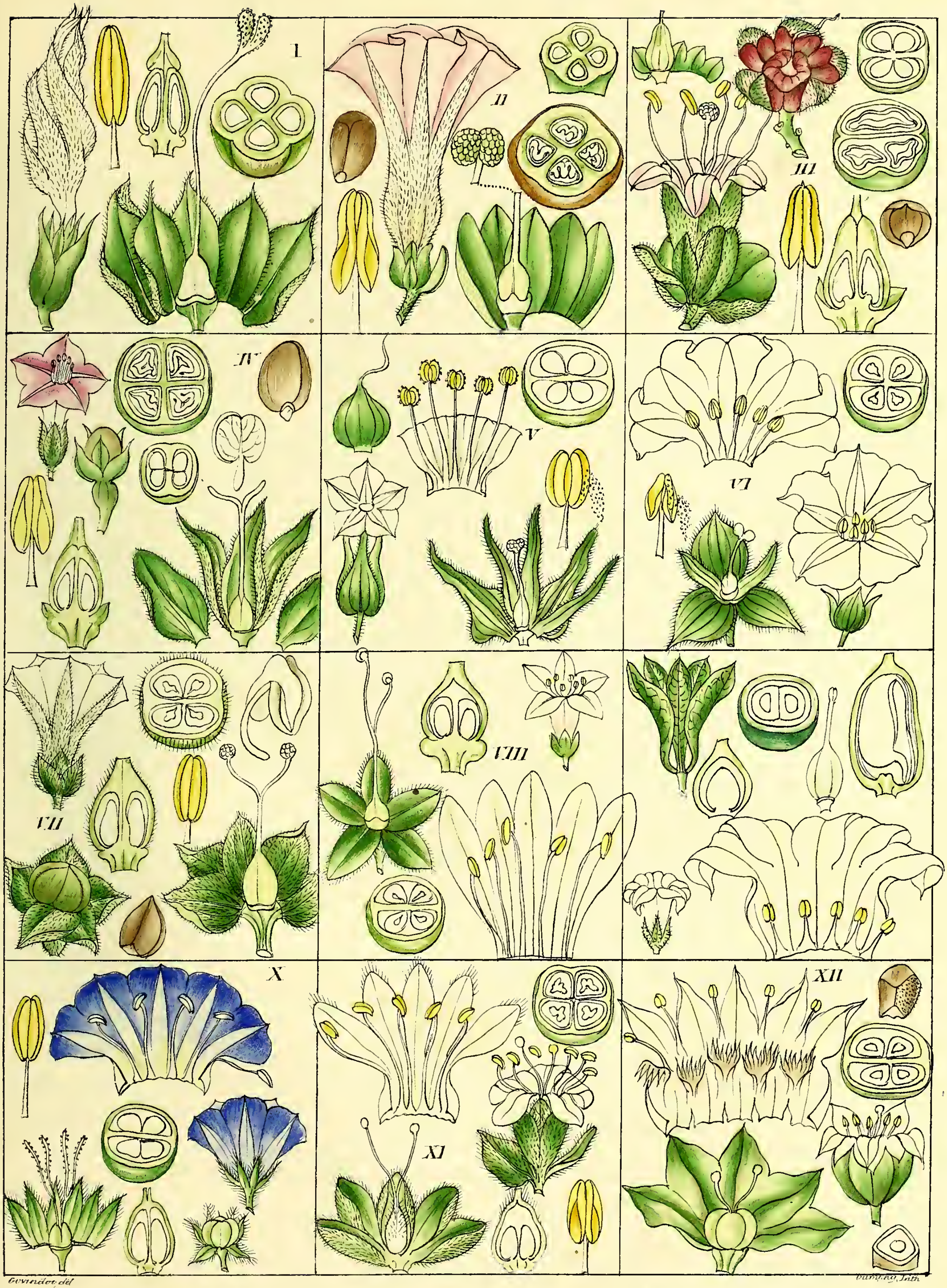
Character of the Order.—Calyx free, often persistent, sometimes enlarging with the fruit, 5- (very rarely 4-) cleft or parted; sepals valvate in æstivation. Corolla hypogynous, deciduous, monopetalous, usually 5-lobed; tube more or less elongated; limb spreading or erect, sometimes slightly unequal; æstivation various, usually imbricate with one lobe often exterior. Stamens as many as the lobes of the corolla; anthers erect or incumbent, 2-celled; cells parallel, opening lengthwise. Ovary consisting of 2 (anterior and posterior) more or less distinct, 2-celled carpels; cells concrete or separate, 1-ovuled. Torus depressed or elongated, bearing the carpels, inserted either by the base or by the bark. Style between the separate carpels or springing from the apex of the concrete ones, simple, bifid, or twice bifid at the apex. Fruit various, from 4- to 1-seeded. Seed without, or with thin fleshy albumen; embryo straight, inverse, rarely curved; cotyledons foliaceous, entire, flat or plicate.—Herbs, undershrubs, shrubs or trees; with the surfaces of the leaves calyx and ramuli usually beset with bristles, and at length with whitish scales, the indurated bases of the hairs. Branches terete or irregularly angled. Roots, especially of the Borragineæ, often tinged brownish red with a peculiar resin-like colouring matter, soluble in water, spirits or oil. Leaves alternate, simple, exstipulate, usually rough or variously bristly. Racemes or spikes (rarely corymbs) variously disposed, often secund and circinate before evolution.

He divides the order into the four following tribes:

Tribe I Cordieæ. Ovary undivided; style terminal, twice dichotomous at the apex, rarely wanting. Fruit baccato-drupaceous, 4-seeded. Cotyledons longitudinally plicate; albumen none.—Shrubs or small trees.

Tribe II Ehretieæ. Ovary undivided; style terminal, 2-lobed at the apex. Fruit baccate or indehiscent. Albumen thin, fleshy.—Shrubs or small trees.

Tribe III. Heliatropeæ. Ovary terminated by a simple style. Fruit dry, separable. Seed exalbuminous.—Shrubs or herbs.



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I. RIVEA. II. ARGYREIA. III. LETTSOMIA. IV. CONVOLVULUS. V. ANISEIA. VI. HEWETIA

VII. BREWERIA. VIII. PORANA. IX. PORANA. X. EVOLVULUS. XI. CRESSA. XII. CUSCUTA

Tribe IV. Borrageæ. Ovary consisting of 2 two-celled or separable carpels; Style central baselar, springing from the gynobase. Fruit 2–4-parted, of 2 two-celled or 2-partible carpels. Seed exalbuminous.—Shrubs or herbs. This last is divided into 6 subtribes, sometimes differing from each other nearly as much as the tribes do among themselves. These I deem it unnecessary to introduce, there being so few Indian species referable to this tribe.

Affinities. De Candolle briefly remarks of these, "an order approaching *Labiatæ* and *Verbenaceæ* by the structure of its fruit, and *Solanaceæ* and *Hydrophyllaceæ* by its flowers." Lindley remarks of *Cordiaceæ*, "The plaited cotyledons and dichotomous style first led to the separation of this order from Borrageworts, with which it was formerly associated, chiefly it is to be supposed, on account of the roughness of the leaves. Von Martins remarks that it is in fact much nearer *Convolvulaceæ*, from which it differs in its inverted embryo and drupaceous fruit. It seems to me impossible to admit *Cordiaceæ* even into the same category as *Borrageæ*, the indispensable pecularities of which are gyrate inflorescence and nucamentaceous fruit, neither of which circumstances occurs here."

With respect to the last two circumstances mentioned, the first, the inflorescence, is nearly met here in the decided tendency towards gyration observable in the accompanying species of *Cordia*, and the cotyledons are but very slightly plaited, thus showing so far a strong leaning towards *Ehretiaceæ* in both these points, but differing in the twice dichotomous style, and ascending not pendulous ovules: but the ovary is the same in both, a more important character than one derived from the mature fruit.

In regard to *Ehretiaceæ*, Lindley remarks, "a branch of the old *Borragineæ* distinguished by a terminal style, proceeding from the apex of a perfectly concrete ovary of 4 cells, a baccate fruit, and seeds furnished with thin fleshy albumen. The order is recombined with *Borragineæ* by Alph. De Candolle, but it seems sufficiently characterized by its concrete carpels, and the presence of a small quantity of albumen. The separate not separable nuts of *Borragineæ* are so peculiar, notwithstanding *Cerenthe* has them combined in pairs, that a real objection seems to exist to the disregard of so good a mark by the combination with them of these concrete-fruited Ehretiads."

Under his order *Ehretiaceæ* Lindley ranges De Candolle's 2nd and 3rd tribes. There is no doubt a considerable difference between them and *Borrageæ*, in the ovary and fruit, and especially in the hypogynous origin of the style of the latter, but in other respects we find much affinity and a progressive transition. Between *Cordia* and *Ehretia* the greatest difference I find is in the position of the ovules, ascending in the one, pendulous in the other. The seed, too, differs, being exalbuminous in the former, and more or less copiously albuminous in the latter. The only other distinction of ordinal value between the two is the twice divided stigma of *Cordia* and the simply cleft one of *Ehretia*, but that is neutralized by *Tournefortia* (a genus of *Ehretiaceæ*) in which it is entire. The different position of the ovule is not alone sufficient to constitute an ordinal character, and neither, I apprehend, ought so much importance to be attached to the circumstance of the 4 carpels cohering into a single nut in one, and continuing distinct in the other. The transition, from *Ehretiaceæ* through *Tournefortia* to *Heliotropeæ*, seems easy, though the latter differs nearly as much from the former as *Ehretieæ* does from *Cordieæ;* hence if *Heliotropium* and *Ehretia* may be united as members of one family, there seems but little reason for separating *Cordia* and *Ehretia.*

The passage from *Heliotropeæ* to *Borrageæ* is not quite so smooth as in the preceding examples; the difference in the ovary and fruit, and especially in the hypogynous insertion of the style of the latter being greater. But on the other hand the similarity of habit is more marked and of a kind, for the most part, so conspicuous as to lead even a cursory observer to detect the relationship. It therefore becomes a question of some nicety to decide, whether relationships easily detected by external characters is to give place to others deduced from microscopic research? which those indicated above certainly are. My impression is that the verdict will be in favour of the former; and to that extent, confirmatory of De Candolle's views in this instance.

Endlicher, Meisner, and Lindley agree in assigning to *Cordiaceæ* pendulous ovules; Alphonse De Candolle, on the other hand, says of *Varronia*, "ovula angulo interno cujusvis loculi lateraliter adfixa, basi obtusa, apice latire visa acuminata, facie obs. angustato-truncata, a dorso compressa;" and of *Cordia*, "ovula ut in Varroniis ex obs. in *C. Gerascantho*, aut basi loculi propiora et potius adscendentia ex *C. Chamissoniana*." My observations, as exhibited fig. 6 tab. 169, accurately correspond with his; hence the remark above as to the relative position of the ovule in the two tribes.

The inference I am disposed to deduce from these considerations is, that the four tribes of De Candolle must either be retained as one or split into four orders, and, for myself, I feel disposed to adopt the former alternative. In that case the affinities of the conjoint order become complex; the first tribe perhaps approaching *Convolvulaceæ*, but very distinct, the second and third, *Verbenaceæ*, equally distinct; and the fourth, *Labiateæ*, but still all associating so well with each other that those of one tribe may be mistaken for those of another. This could scarcely happen with species of any other order. Lindley's location of Cordia in his Solanal Alliance between *Asclepiadeæ*, and *Convolvulaceæ* seems to me unnatural, at least I am unable to trace any affinity with the former and, so far as I am acquainted with the order, not much with the latter.

Geographical Distribution. Viewed in its most comprehensive aspect, that is, as understood by De Candolle, this order has a very extensive distribution, its species being scattered all over the world. *Cordieæ*, *Ehretieæ*, and *Heliotropieæ*, all show decidedly tropical predilections, while *Borrageæ*, containing at least twice as many species as all the others put together, is to an equal extent extratropical, being for the most part natives of the more temperate latitudes, abounding in the Southern parts of Europe and Central Asia. Species referable to De Candolle's three first tribes are common in Southern India, while those of the fourth are comparatively unknown. *Trichodesma* and some species of *Cynoglassum*, being almost the only ones to be met with.

Properties and Uses. These are not important. The fruit of some species of *Cordia* are eat by the Natives but are not by any means agreeable to the European palate, being soft and mucilaginous with a kind of mawkish sweet taste. The wood, though some attain the stature of considerable sized trees, is not of much value.

The Ehretias are not much thought of as medicinal agents. The Roots of *E. buxifolia* are used in the same manner and for nearly the same purposes as *Sarsaparilla*. The juice of *Tiaridium Indicum* (Heliotropium Indicum) is employed as an application to painful gum boils, and also to inflammatory affections of the eyelids. According to Martius it is a remedy of undoubted advantage to cleanse ulcers, and allay inflammation. The Peruvian Heliotrope is universally esteemed on account of its delicious fragrance. Of the true Borrages the *Trichodismas* only are sufficiently common on the plains of India to have found their way into the Native materia medica, and they are said to be diuretic. Of the European species, many are employed in the arts for the sake of the dyes furnished by their roots.

Remarks on Genera and Species. The number of Indian genera of this order is small. According to De Candolle's enumeration, there are in all 70 genera; 12 or 13, probably, of which have Indian representatives. In Southern India, *Cordia* stands alone in its tribe. *Ehretia* and *Tournefortia* each furnishes a few species to the second, and 3, out of the 6 genera belonging to *Heliotropieæ*, have Indian species. Of the 53 genera of *Borrageæ*, 9 or 10 furnish Indian species, but these are principally from Northern India. Of the plates illustrative of this order one is appropriated to each of the 4 tribes, *Cordieæ*, *Ehretieæ*, *Heliotropieæ*, and *Borrageæ*, by which means all the three, or rather, if they are to be separted, four orders are represented, should they, ultimately, be declared such; and if not, the transitions of the one large conjoint order may be readily traced through all their gradations. The plant selected to illustrate Heliotropeæ has been long known under the name of *Heliotropium Indicum*, then under that of *Tiaridium*, and now it rejoices in that of *Heliophetum Indicum*. I do not very

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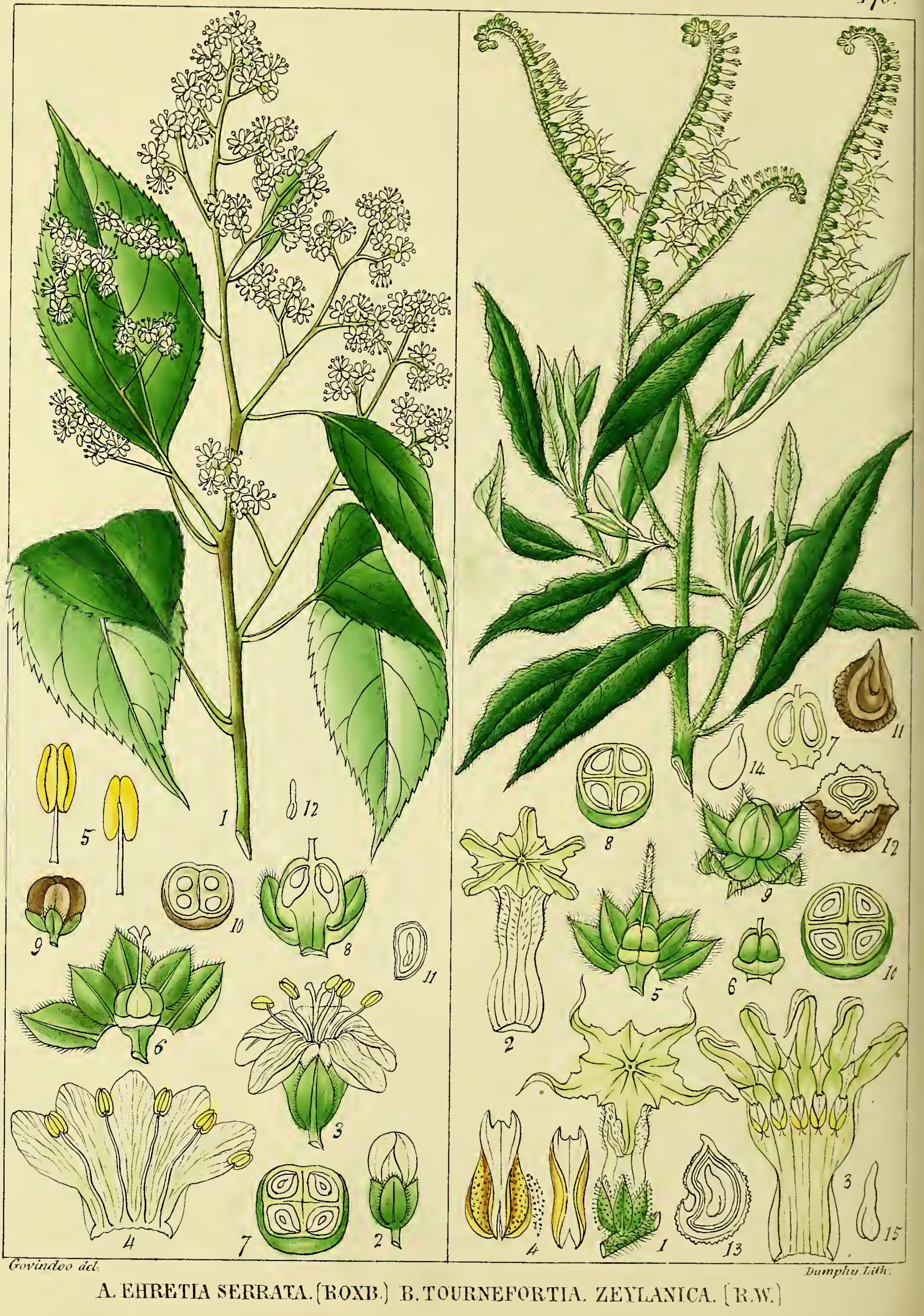
CORDIA. MYXA. (LINN.)



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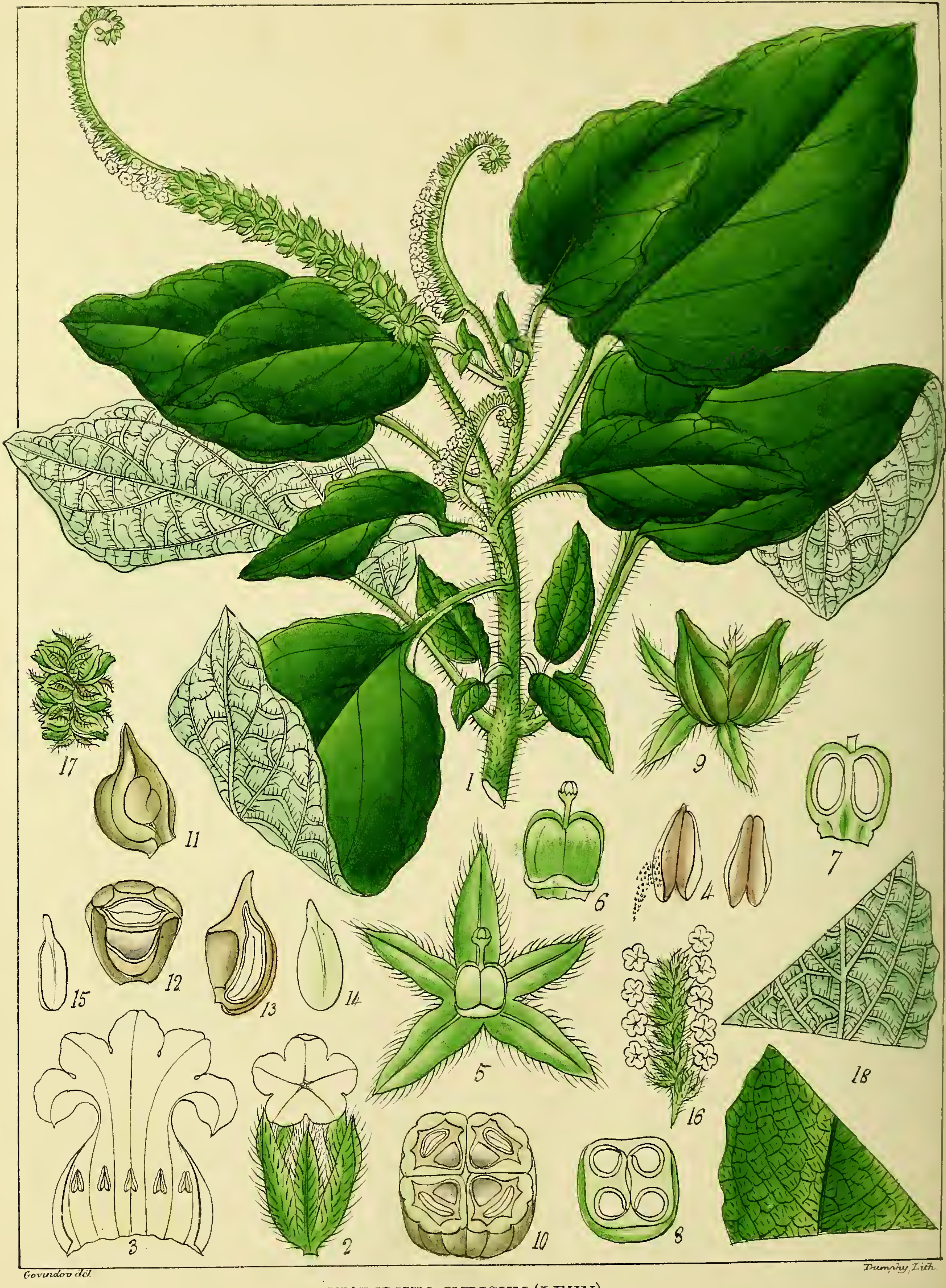
A. EHRETIA SERRATA. (ROXB.) B. TOURNEFORTIA. ZEYLANICA. (R.W.)



TIARIDIUM INDICUM (LEHN)

clearly perceive the object of this last change, nor do I understand on what principle it is made, since it sets aside an older and well established generic name which seems quite uncalled for. The plant represented (plate 170) under the name of *Tournefortia* has long been imperfectly known, from a passing good figure in Burmann's Flora Indica, under the name of *Heliotropium Zeylanicum*, under which I published it in my Icones. More intimate acquaintance with the order having enabled me to detect my mistake, I take advantage of this opportunity to publish a new and more correct figure under its proper generic appellation. It is, in many parts of India, a common annual growing in cultivated fields, flowering during the rainy and cool seasons, and is, I believe, the only species of the genus found on the plains of Southern India; there is another common about Point de Galle in Ceylon, and a third I found on the Neilgherries; a fourth, *T. Heyneana*, is described, perhaps from Mysore, and three or four are natives of the more Northern provinces. A genus so rare, merits being better know than it has hitherto been in India. The species of *Ehretia*, here given, is not a native of the peninsula, but as no figure of it has yet appeared in any Indian botanical work, and having authentic specimens, I preferred it to better known species, while it has the advantage of furnishing the link connecting *Ehretieæ* and *Cordieæ* through its sub-corymbose, scarcely gyrate inflorescence.

EXPLANATION OF PLATE 169.

Cordia Myxa. (Linn.) flowering branch, natural size.
1. Expanded flower.
2. Corolla split open to show the stamens in situ.
3. Anthers.
4. Ovary and calyx.
5. Ovary cut transversely, 4-celled.
6. Ovary cut vertically, ovules erect.
7. Portion of a corymb of full-grown fruit.
8. A detached ripe drupe.
9. The nut.
10. Nut cut transversely, aborted.
11. A seed.
12. The same, testa removed to show the plicate cotyledons and inferior radicle.
13. Portions of a leaf magnified.

EXPLANATION OF PLATE 170.

A. 1. *Ehretia serrata*, (Roxb.) flowering branch, natural size.
2. Flower-bud
3. Expanded flowers.
4. Detached corolla.
5. Anthers.
6. Calyx and Ovary.
7. Ovary cut transversely.
8. —— vertically, ovules pendulous.
9. A mature berry slightly magnified.
10. Cut transversely all the seed matured.
11. Detached seed cut longitudinally, showing the embryo in situ.
12. Detached embryo.

B. *Tournefortia Zeylanica* (R. W.), flowering branch, natural size.
1. Detached flower. 2. Detached corolla.
3. Corolla split open showing the stamens in situ.
4. Anthers, back and front views.
5. Calyx and ovary. 6. Ovary detached.
7. Ovary cut vertically more highly magnified.
8. Cut transversely.
9. Mature fruit.
10. Detached nut.
11. Nut cut transversely.
12. Cut longitudinally, embryo in situ.
13. Detached seed.
14. Detached embryo.

EXPLANATION OF PLATE 171.

1. *Tiaridium Indicum* (Lehm.), flowering branch, natural size.
2. Detached flower.
3. Corolla split open, anthers in situ.
4. Detached anthers.
5. Ovary and calyx.
6. Ovary detached.
7. Cut vertically.
8. Transversely.
9. Mature fruit, side view.
10. Fruit cut transversely.
11. A detached nut.
12. Cut transversely.
13. Longitudinally.
14. Detached seed.
15. Cotyledons, testa removed.
16. Portion of a flowering spike.
17. Portion of a fructiferous one.
18. Upper and under surface of the leaf. All more or less magnified.

EXPLANATION OF PLATE 172.

1. *Trichodesma Indicum*, a small plant, natural size.
2. An unexpanded flower-bud.
3. An expanded flower seen from above.
4. The same, front view.
5. Detached corolla split open, stamens in situ.
6. Detached stamen.
7. Calyx and ovary.
8. Detached ovary.
9. Ovary cut transversely.
10. Cut vertically.
11. Mature fruit.
12. Fruit cut transversely.
13. A detached nut.
14. Nut cut transversely.
15. Detached cotyledons.
16. Portions of a leaf, upper and under side.

CXIX.—VERBENACEÆ.

This large and complex order was first indicated by Jussieu, under the name of *Vitices*, which name he subsequently changed to the one now given. His materials for the elucidation of the family, at that remote period (60 years ago), seem to have been more perfect than those for most of his other orders, as the number of genera referred to it by him is exactly half those assigned by Schauer in De Candolle's Prodromus in 1847; the numbers in the two works being respectively 21 and 42. It is an order which has long stood in need of a comprehensive revision, but no one seems to have taken sufficient interest in it to induce the attempt being made as a new and original work. Walpers' account of it, in his Repertorium Botanicum, was, up to the appearance of De Candolle's 11th Volume, the only one extant, and that simply claimed the merit of being a compilation from the writings of others, not a revision of the order, and as such, by bringing together what was known, was, at the time of publication, a valuable contribution to the working Botanist, and was all I had to aid me in naming the species published in my Icones, which will account for some changes of nomenclature which became necessary on the receipt of the more complete work.

Schauer divides the order into three tribes, viz.

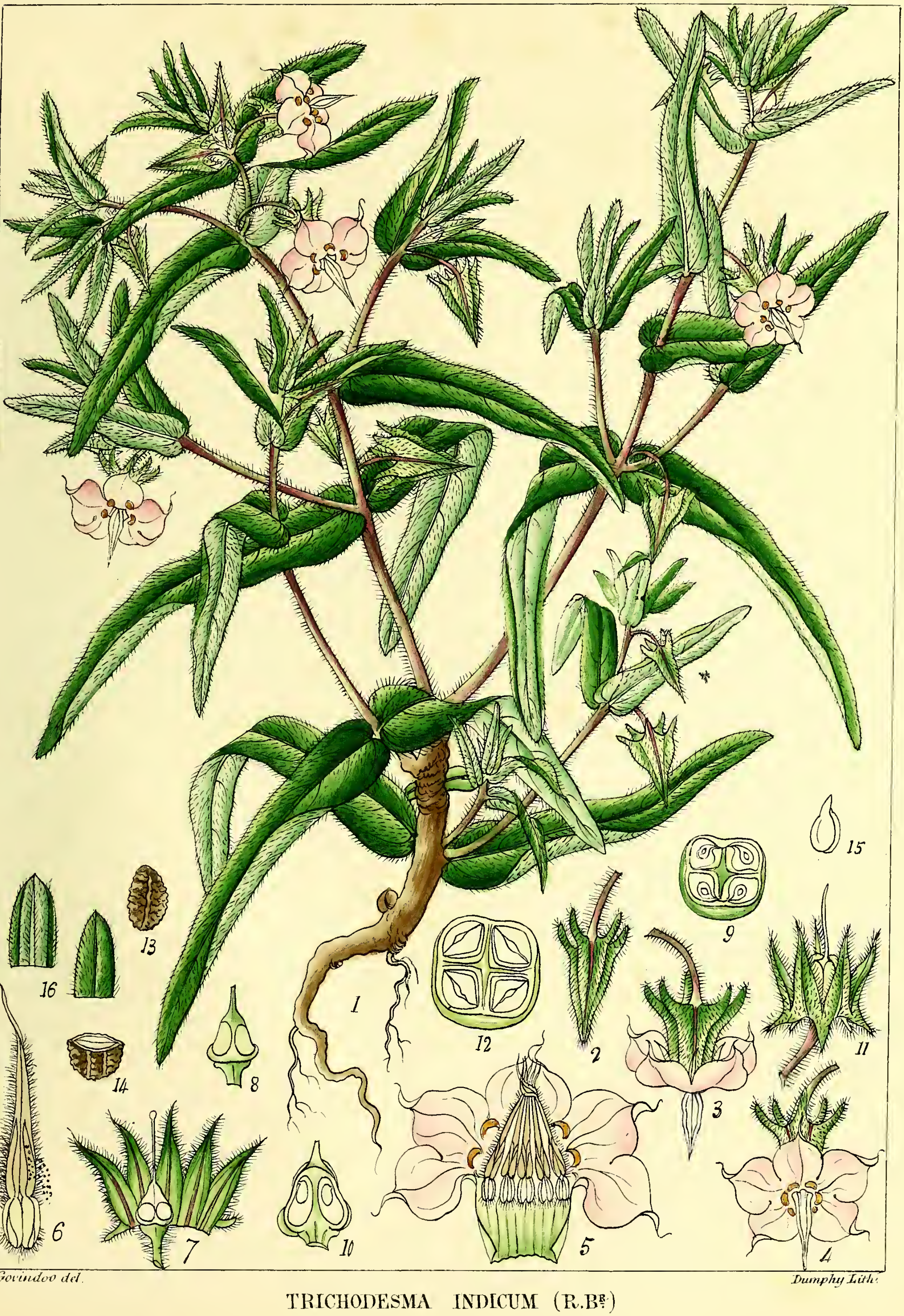
Verbeneæ. Ovules erect, rising from the base of the cells of the ovary, anatropous.

Viteæ. Ovules inserted above the base on the central angles of the cell, pendulous, amphitropous or sub-anatropous.

Avicenniæ. Ovules geminate in the cells, pendulous from the apex of the axis, amphitropous.

These distinctions, being for the most part accompanied by differences of habit and external characters, are convenient and practically useful but, according to my observations, they are not always quite correct. The two first tribes are further divided into 10 sub-tribes. In regard to one of these, *Symphoremeæ*, he seems to have taken an erroneous view of the structure of the ovary and position of the ovules. I find that the ovary and ovules of that sub-tribe are identical with those of *Avicennieæ*, that is, only partially 2-celled, the partition not reaching to the apex of the cell, with the 4 ovules suspended 2 and 2 from the free apex of the placenta, and prolonged downwards till they terminate in a membranous subulate point; hence they are in neither case amphitropous, or in other words attached by the middle, so that the two ends are equidistant from the point of insertion. The ovarial structure of these two tribes is so remarkable that it might almost be doubted whether they ought not to be separated on that very account to form the type of a distinct order. Were such a course adopted, the two divisions of the order would assort badly; whence I esteem them better left where they are, but I certainly think *Symphoremeæ* should be excluded from the tribe *Viteæ*, and be itself raised to that rank. As it now stands it breaks up what would otherwise be a natural group.

The structure of the ovary of these two groups differs from that of the true *Viteæ*, in having the lower half of the ovary truly 2-celled, while most of the others have it only spuriously so. This statement, being at variance with the observations of my predecessors who have written on this order, seems to demand some explanation.



Govindoo del. Dumphy Lith.

TRICHODESMA INDICUM (R.Br.)

A one-celled ovary is one where the margins of the carpellary leaves are not so far inflexed as to meet and coalesce in the axis, and therefore leave an empty space in the centre; a two- or more celled one is where these margins meet and coalesce in the axis. Of the first there are two degrees—first, where they meet in the periphery and are not inflexed, having the placentæ either central or parietal—second, where they are so far inflexed that they nearly meet but, owing to the edges becoming reflexed, do not cohere. In this last case the partition, in place of resembling a room with a wall built across, resembles one divided by folding doors which, though they may touch, can still be withdrawn without causing any breach of continuity. This last form is not deemed a true partition, and ovaries in which it occurs are not considered truly 2-celled. Such ovaries are said to be spuriously 2-celled, such is the ovary of *Clerodendron*, *Vitex*, *Premna*, and I believe some others of that tribe. For other examples of this form of ovary see the figures of *Gentianeæ*, *Orobancaceæ*, *Gesneriaceæ*, &c. Such a structure seems never to have been suspected in this order; hence Mr. Griffith's astonishment on finding it in the genus *Glossocarya*, which he describes as having an "Ovarium 1-loculare ! placentæ bilamellatæ, lamellis recurvato-incurvis; ovula 4 pendulo-apensis." Schauer, however, either did not see the line of separation between the two semi-partitions or folding doors, or does not consider cohesion necessary to the formation of a 2-celled ovary, and assigns to that genus that structure.

Be that, however, as it may, I find a similar structure in other genera of the order, showing an analogy if not a positive affinity between *Viticeæ* and *Bignoniaceæ*, and even *Acanthaceæ*. *Symphoremeæ* and *Avicenneæ* differ from both these forms in the structure of their ovary, which is *partially* 2-celled, that is, the partition wall, if I may so say, is not raised to the ceiling, so that it is 2-celled below and one-celled above: which is my reason for wishing to separate the former as a distinct and well marked tribe from *Viteæ*. In *Myoporaceæ*, an order to which *Avicenneæ* is so nearly related that Brown referred it there, I do not find this structure. In it, the ovules are really attached to the upper angles of the cells which are complete, at least I find them so in the only species I have at hand to examine, namely, *M. congestum* and *acuminatum*. This difference, though microscopic, seems one of considerable import, especially when combined, which I believe it is, with difference of habit. But on that point I speak with diffidence, having so little acquaintance with the order. *Gmelina* differs from the *Viteous* genera above mentioned in having a distinctly four-celled ovary, with a single ovule in each, pendulous from the upper central angle, just as in *Myoporaceæ;* it also corresponds with that order in the character of the anthers; and, as regards the corolla and fruit, I think agrees even better than with *Verbenaceæ*. For these reasons I am disposed to view the genus as the transition one, uniting the two orders and, perhaps, of the two more justly referable to the former. Under this impression I have introduced a figure of *Gmelina* with the view of making known, through its medium, the characters of *Myoporaceæ*, and show how nearly they approach each other, and have added in the upper corner of the plate some outline sketches, copied from Endlicher's Icones, of a species of that order which I think go far to prove that *Gmelina* is erroneously placed in this order, as it only differs from the other in its 4-lobed corolla.

Character of the Order. Flowers hermaphrodite, rarely polygamo-dioicous, 4–5-merous, rarely more; regular or irregular or bilabiate, unibracteate; bracts sometimes enlarging after blooming. Calyx free, monosepalous, 4–5- rarely 6--8-toothed, persistent, more or less enlarging with the fruit. Corolla hypogynous, monopetalous, tubular, deciduous; limb 4–5- sometimes 6–12-lobed, usually unequal, secund or more or less perfectly bilabiate, rarely equal; æstivation imbricate (in Symphorema, inflexed). Stamens inserted on the tube of the corolla, incluse or exserted, 4–5 rarely more; usually didynamous, and all fertile, or with a superior exantheriferous or rudimentary one; anthers 2-celled; cells generally opening longitudinally, parallel, divaricate or vertically superposed; connectivum sometimes produced beyond the cells. Ovary free, seated on an annular disk composed of 2 or 4 carpels; 2–4-celled with the margins of the carpels forming the primary partitions, or by these partitions, sometimes, splitting within the cavity and introflexed, 4–8-celled. Ovules usually solitary in the cells, rarely geminate, collateral, or two opposite; erect from the base, anatropous, in *Verbeneæ*, in the other tribes

pendulous from an ascending parietal spermophore in the central angle of the cell; style terminal, simple; stigma undivided, capitate or bifid. Fruit either capsular of 2–4, or rarely 6, one-seeded cocci, separating at maturity, or drupaceous, 1–2-celled. Seeds erect, axalbuminous: embryo straight, cotyledons thick, oily; radicle inferior, short.—Herbs, shrubs, or large trees, sometimes scandent, often furnished with resinous glands, thence aromatic or fetid: ramuli 4-sided. Leaves opposite, whorld or alternate, simple or pinnate, incised, divided or digitate; stipules none. Inflorescence either indefinite (centripetal), racemoso-spicate, capitate or definite (centrifugal) di- or trichotomously cymose; cymes axillary or forming terminal panicles. Calyx and bracts often coloured, enlarging with the fruit. Corolla variously coloured, white, red, blue, yellow; often small and inconspicuous.

This, as it now stands, is a large and heterogeneous order, which, it is my impression, will yet be split into several. For the present, Schauer distributes it under the following tribes:

Tribe I. Verbeneæ. Inflorescence indefinite, racemose, spicate or capitate. Ovules erect from the base of the cell, anatropous.—Herbs or shrubs, very rarely trees. Leaves simple, often cut, but never compound.

Tribe II. Viteæ. Inflorescence definite, di-trichotomously-cymose; cymes axillary or collected into a compound panicle. Ovules inserted about the base of the cell, on the central angle, pendulous, amphitropous or sub-anatropous.—Trees or shrubs, very rarely herbs. Leaves simple or digitate.

Tribe III. Avicennieæ. Inflorescence capitate or spicate, centripetal. Flowers sessile, opposite; each supported by a bractea and two imbricated scale-like bracteoles. Ovary 2-celled with 2 ovules in each, pendulous from the apex of the central angle, amphitropous. Capsule coriaceous, indehiscent, with the embryo germinating within the pericarp, at length bursting forth. Tropical trees inhabiting salt swamps along with *Rhizophoræ* and *Ægiceræ*.

Affinities. Each of the above tribes, while certainly more nearly allied to each other than to other families, seem to claim for themselves a different set of affinities. The first, as here arranged between *Borragineæ* and *Labiateæ*, seem to occupy the most suitable place that could be assigned to them, for the relationship between them and *Labiateæ* is certainly near but still they can scarcely be comfounded. They also approach *Heliotropieæ* of *Borragineæ*, but scarcely so nearly. The *Viteæ*, excluding *Symphoremeæ*, on the other hand, recede from Labiateæ and Borrageæ in their arboreous habit, but nearly approach both *Cordieæ* and *Ehretieæ*, in that, and also in their ovary, fruit, and seed, but widely depart from them in the characters of their flowers. Through these (their flowers), added to their spuriously 2-celled ovary, exalbuminous seed, and opposite (often compound) leaves, they approach the Bignonal Group. And lastly, *Avicenneæ* is allied both by habit and structure to *Rhizophoreæ*, on the one side, and *Myoporaceæ* on the other; so nearly indeed to the last, that Mr. Brown has in his Prodromus referred it to that family. *Symphoremeæ* associate, by their ovarial structure and solitary seed, with Avicenneæ, but depart from them in the structure of their seed and scandent habit. Their more remote affinities are unknown to me. If these views are even approximations to the truth, it follows that this large order is about as complex in its affinities, as it is heterogeneous in its species.

Geographical Distribution. The order *Verbenaceæ*, as a whole, is abundant within the tropics of both hemispheres; *Verbeneæ* predominate in America, *Viteæ* in Asia. A few are found in Africa and Australia, and a very few in Europe. Single species are found distributed over vast tracts of country, especially in America. Some are natives of both America and Southern Africa, a few are cosmopolite (*Verbena officinalis* and *Lippia nodiflora*) in warmer and temperate regions all round the world. *Avicenneæ* are natives of salt marshes within the tropics of both hemispheres.

Properties and Uses. With the exception of the timber, of perhaps two or three species, the Teak (*Tectona grandis*) and *Vitex arborea*, and some others, the benefits derived by man from this family are of very secondary value. As medicinal agents several are

employed in domestic practice but not one, so far as I am aware, in the practice of the Physician. Nearly all the species of *Premna* exhale a heavy most disagreeable musky smell, when bruised, and so do some* if not all the Vitices—*V. negundo* and *trifoliata* certainly do—and on that account are often dried and mixed with cloths or put between the leaves of books to prevent attacks of Insects. The Natives hold the leaves of both in considerable esteem as medicinal agents, and prescribe them in various forms, but I suspect faith in these supposed properties has often more effect than any active property they possess.

The timber of the *Tectona grandis* is about the most highly esteemed of any in India; that of nearly all other trees is spoken of as Jungle-wood, and inferior. Time does not now permit, otherwise some remarks might have been offered on the subject of the preservation of the Teak forests and the recent fearful waste and destruction of that valuable, I had almost said invaluable, tree in all our teak forests, without a single step being taken either to keep up the stock or preserve young trees from the ruthless hands of contractors and others licensed to cut Teak timber. Measures are now, I believe, in progress to arrest the ruinous destruction that has for some years been going on, and it is to be hoped the Directors will succeed in their object, as otherwise the stock in hand will soon be exhausted. Griffith's *Hemigymnia*, is described as attaining dimensions nearly equal to the Teak, and yielding timber of great strength and elasticity, but it does not seem to have such an extensive range, and possibly if attempted to be propagated elsewhere would not succeed. Plants so local as it appears to be, and so limited in their geographical range, being generally difficult of propagation.

Remarks on Genera and Species. For the reasons stated above, my observations under this head, must unavoidably be brief, indeed almost confined to the subtribe *Symphoremeæ*, which, owing to my set being very complete and Walpers' account of them imperfect, I was induced to scrutinize with considerable care. The result of that examination I published in the Icones, in which I have given figures of 10 species; Schauer's list extends only to seven. A more recent examination of the ovary has induced me somewhat to alter my views of its structure. In the following remarks it is said to approach *Myrsineaceæ*. This is not exactly the case, as I now find it is distinctly 2-celled, but with the partitions so thin that, in a vertical section, they are easily torn and apt to be overlooked unless expressly looked for, giving the appearance of an erect central placentiferous axis, from the apex of which the ovules are suspended. The ovary is however correctly described by Schauer as 2-celled (except at the apex) with 2 collateral ovules in each, pendulous from the apex. They are exactly as in *Avicenneæ*, not amphitropous but rather anatropous and, as in *Avicenneæ*, only one is fæcundated. These striking agreements between the two groups of plants led me then to suggest the elevation of *Symphoremeæ* to the rank of a distinct tribe, in place of retaining it as a subtribe of *Viteæ*, a view which my more recent examination has greatly tended to confirm.

The difference of the inflorescence and flowers, and general habit, stand as an almost insuperable obstacle in the way of its association with *Avicenneæ* as an order. On the genus *Avicennia* I at the same time offered some remarks bearing on the discrimination of 2 species figured in the Icones; these also I introduce here in connexion with the remarks on Symphoremeæ. Beyond these, nothing occurs to me demanding notice, having already referred to the discrepancies of *Gmelina*; Schauer's Monograph being, so far as I can judge, generally so perfect as to leave little to be desired.

Symphoremeæ.

This small group of plants, brought together as a subtribe of *Viticeæ*, ought, it appears to me, to constitute the type of a tribe, or even a separate order, allied to, but distinct from, *Verbenaceæ*, differing as they do from the rest of the order in the inflorescence, the ovary, the placentation, and the seed. It is thus defined by Schauer, in DC.'s Prod.:

"Sub-tribe Symphoremeæ, cymes contracted glomerate, few-flowered; involucrate. Corolla regular or bilabiate. Stamens 4–5, or indefinite. Capsule coriaceous, indehiscent, 1-seeded by abortion.—Flowering shrubs with simple leaves."

This definition, so far as it goes, seems correct. The cymes might, perhaps, with equal or greater propriety have been called simple umbels, and, having an involucre, they convey the idea of an umbel, rather than that of a cyme. The involucre itself, constitutes a peculiar feature, erroneously described in the generic character of *Symphorema* as "6–8-phyllum," but correctly in the description of the species, as being composed of 2 bracts and two bracteoles to each. Such is

indeed the composition of the involucre in all the three genera. In *Symphorema* and *Spenodesme* it is composed of 2 opposite bracts, each furnished with two somewhat smaller bracteoles: each leaflet bearing a sessile, axillary flower at the base, and a single flower in the centre, without a fulcrum. In *Congea* one of the bracteoles of each bract aborts, while the opposite, contiguous pair often unite, reducing the four parts to three, giving the appearance of a 3-phyllous involucre.

In the numerous specimens of both *Symphorema* and *Sphenodesme*, I have examined, I have always found the involucre 6-phyllous, and only once (No. 1478), with fewer than 7 flowers and never more. In *Congea*, the involucre is four- or, by the union of the 2 bracteoles, reduced to 3-phyllous, with from 5 to 7 flowers; that is, a flower to each leaflet, and a central odd one unsupported, or two to each bract, one to each bracteole and the odd one. Both Roxburgh and Schauer describe the glomerulus of *Congea* as 6–9-flowered. I have not yet met with more than 7, nor fewer than 5 in any glomerulus, of either of the three species I have examined, thence infer that the statement has originated rather in loose generalization, than actual and careful counting to determine the point.

Does the composition of this involucrum throw any light on the vexed question of leaves and stipules of *Galiaceæ*, or in any way tend to clear up the difficulty there experienced in determining what are leaves and what stipules?

The umbellate inflorescence and characteristic involucre, seem of themselves to constitute this, at least, a peculiar tribe, if not a separate order; but when to these are added the semi-one-celled ovary and remarkable placentation, approaching that of *Myrsineaceæ*, and the farctuose seed, nothing seems wanting to justify its elevation to the dignity of a tribe: it is my impression even an order, amply distinct from true *Verbenaceæ*. As a tribe, the structure of the ovary and placentation place it between *Viticeæ* and *Avicenneæ*, as it corresponds with that of the latter, viz., "Ovula in loculo gemina, ex apice axeos pendula amphitropa," and to that extent is more nearly allied to the latter, than to the former, in which Schauer places it as a subtribe.

The following abbreviated essential characters of the genera I had prepared before Schauer's Monograph reached me, and as they differ slightly from his, I introduce them. To complete the Illustrations of the tribe, I have given the analysis of *Symphorema polyandrum*, in No. 1474.

Symphorema. Involucre 6-phyllous, 7-flowered. Corolla regular, many-cleft; segments inflexed in æstivation. Stamens equaling the number of lobes of the corolla, alternate with them.

Sphenodesme. Involucre 6-phyllous, 7- rarely 3-flowered. Corolla sub-irregular, 5-lobed, imbricate in æstivation. Stamens 5, inserted on the throat of the corolla, alternate with its lobes, shortly exserted.

Congea. Involucre 4- or, by union of the lateral pair, 3-phyllous, 5–7-flowered. Corolla bilabiate, upper lip much produced, 2-parted, imbricate in æstivation. Stamens 4, didynamous, long, exserted.

Congea. (Roxb.)

When naming the subject of 1472 I had not seen Schauer's Monograph. He, I find, reduces *C. villosa*, Roxb., and *C. azurea*, Wall., referring both to C. *tomentosa*, Roxb. I am unable to say how far he is correct in considering *C. villosa* and *azurea* identical, not having an authentic specimen of the former, but I certainly cannot coincide with him in combining *C. azurea* and *tomentosa*, which I consider quite distinct, and therefore presume he has fallen into error through the imperfection of his materials. To prevent, as far as I am able, the extension of the confusion likely to arise from this accidental error, I have determined to give a figure of *C. tomentosa* for comparison with Wallich's *C. azurea*, the drawing of which is taken from an authentic specimen. To these I add one of what I now consider a new species. The plants from which the drawings are made may be thus briefly distinguished:

C. azurea (Wall.), leaves elliptic, acute, or sub-mucronate at the apex, slightly hispid above, softly velutino-pubescent beneath: leaflets of the involucrum obovate, oblong, sub-cuneate towards the base, softly velutino-pubescent on both sides: umbels 5–7-flowered: calyx teeth narrow, lanceolate, acute.

C. tomentosa (Roxb.), leaves ovate, slighly cordate, acute, or sub-acuminate; hispid above, tomentose beneath: leaflets of the involucre oval, obtuse at both ends, tomentose above, softly pubescent beneath: umbels 7-flowered, calyx teeth short, blunt.

C. velutina (R. W.), leaves ovate, acuminate, glabrous on both sides, coriaceous, leaflets of the involucre obovate, spathulate, dilated and cohering at the base, forming a cup in which the flowers are seated, velvety on both sides; umbels 5-flowered: calyx teeth very short, obtuse.

In all these I find indications of the compound nature of the third leaflet of the involucre, but in one specimen of the last, there are several instances of the bracteoles remaining permanently distinct, as shown in Fig. 2. B. Plate 1479, thus clearly explaining what might otherwise have remained a conjectural inference.

Avicennia. (Linn.)

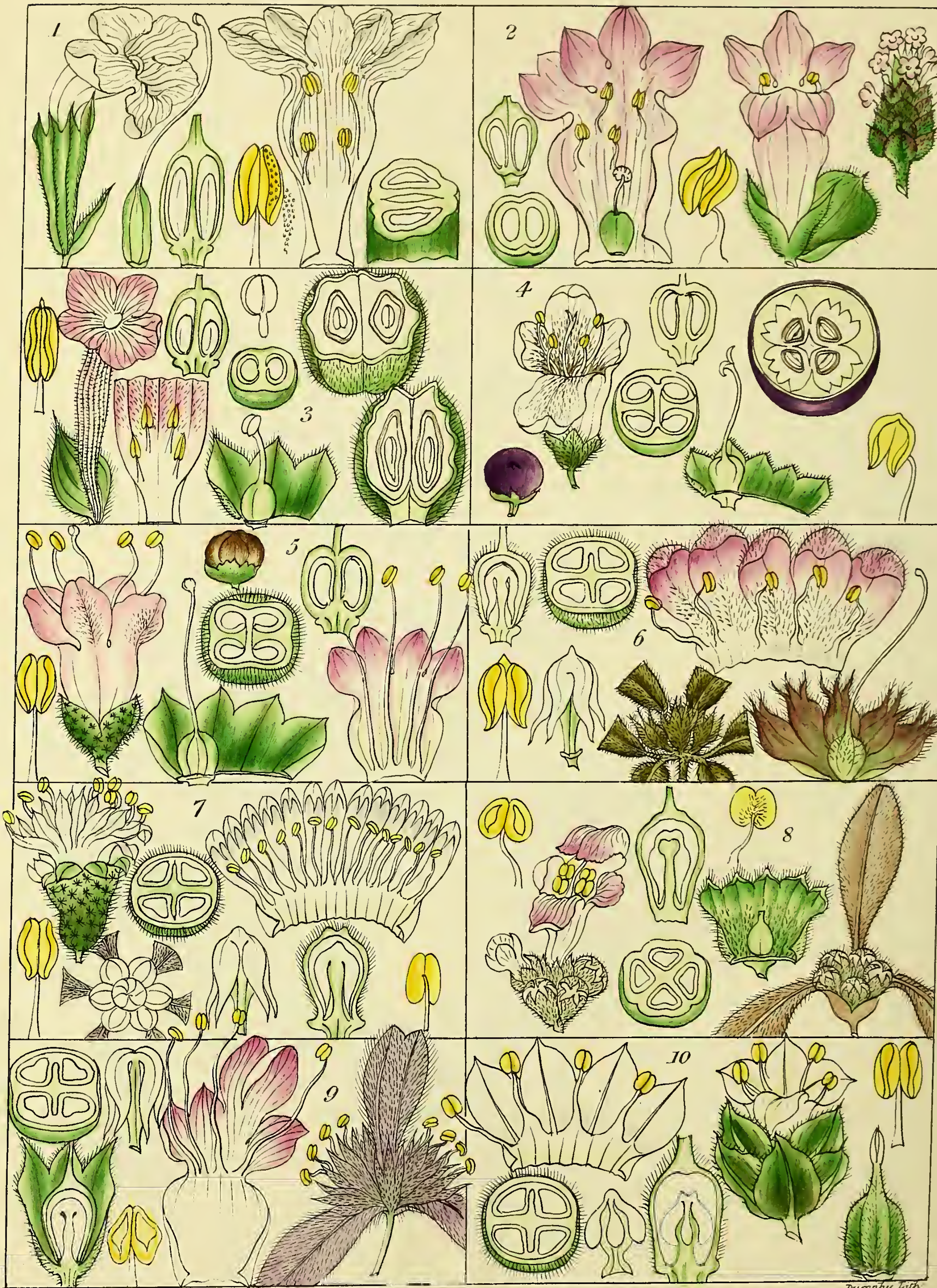
This genus associates with Symphoremeæ in the character of its placentation, but differs in the seed. Much uncertainty seems to exist among Botanists as to the limits of its species. Walpers has 2 species, but assigns to one of these no fewer than 7 distinguishable varieties; Asia, Africa, America, Australia and the Philippine Islands, each contributing to the list. The two plants here figured are considered by him identical, not even varieties. Blume has not given figures of his plants, hence I presume their supposed identity. Schauer in his Monograph describes 4 species, distributed under two sections, viz.:

1. "*Donatia*, stylus manifestus, post corollæ lapsum e calyce exsertus.

2. "*Upata*, stylus sub-nullus, stigmata in vertice, ovarii fere sessilia."

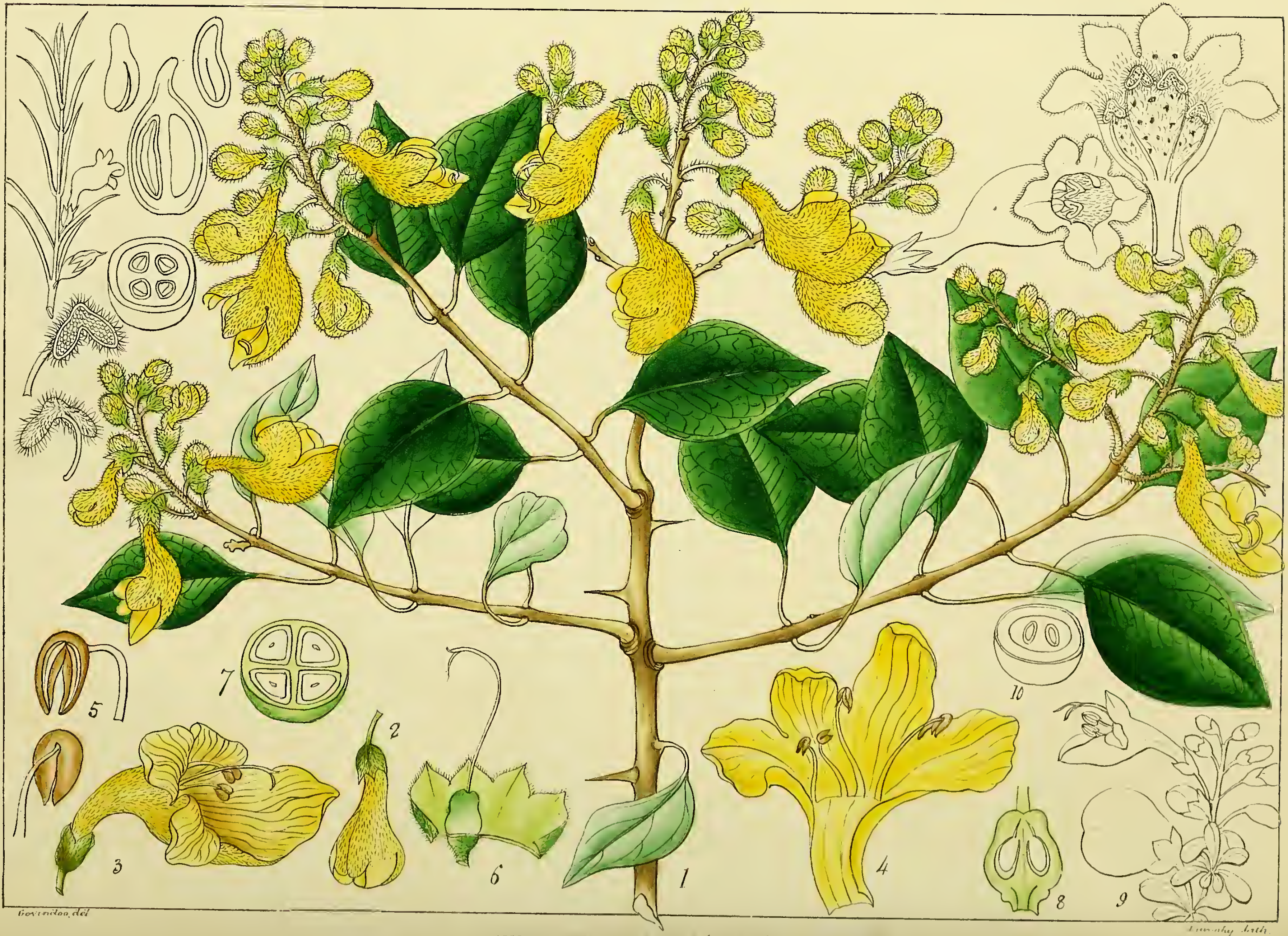
He, like Walpers, refers both to the same species, which he calls *A. officinalis*, and places it in the 2d section along with *A. tomentosa*, which name he restricts to the American plant. On the correctness or other-

CLERODENDRON SIPHONANTHUS. (R.Br.)



Govindoo, del. Dunphy, lith.

1. 2. VERBENEÆ. 3. LANTANEÆ. 4. 5. VITICEÆ. 6. 7. 8. 9. SYMPHOREMEÆ
10. AVICENNIEÆ.



Govindoo, del.

GUBELINA ASIATICA (LINN)

wise of that division, I am unable to offer any opinion, never having seen it, but I am not prepared to go along with him in viewing the two plants here represented as the same species, though nearly allied. When naming the drawings, I adopted Blume's views, and still, perhaps erroneously, retain his name. He may be in error in considering the Java plant identical with the American one, but not in viewing his *A. alba* as distinct from his *A. tomentosa*, if I have not erred in viewing these as his plants.

1841. Avicennia tomentosa (Lin. Blume, *A. officinalis*, Lin., Schauer), leaves obovato-cuneate, obtuse, glauco-tomentose beneath. Bl.

Malabar coast, and generally to be met with in salt marshes on both coasts of the Indian Peninsula.

A small tree or considerable shrub, with obovate, obtuse, coriaceous leaves, light green above, whitish or greyish beneath; petiols densely villous above: peduncles axillary and terminal, trichotomously panicled; branches short, stout, terminating in a single capitulum, or elongated and bearing several sessile, lateral ones; bracts concave, coriaceous, 3 to each flower, and, like the calyx lobes, ciliate, calyx 5-parted, lobes ovate, obtuse, glabrous. Corolla scarcely exceeding the calyx, 4-cleft, lobes ovate, acute, pubescent on the back, yellow: stamens 4, about equal, scarcely exserted; anthers globose, deeply furrowed between the cells. Ovary ovate, pubescent, imperfectly 4-celled, with 2 ovules in each, pendulous from the free apex of an erect, central placenta: style short, cleft at the apex: fruit oblique, ovate, compressed, apiculate, roundish at the base, supported by the persistent calyx and bracts.

Schauer has revived for the this species Linnæus' specific name "officinalis," and I think correctly, as it differs in some points from the American plant to which he restricts Linnæus' "tomentosa." Linnæus however did not think them distinct, as he afterwards reduced his A. officinalis. In the American plant, the flowers are white, in the Asiatic one, yellow, a difference which, in so difficult a genus, ought not to be overlooked in the determination of its species.

1482. Avicennia alba (Blume), leaves oblong, lanceolate, acute, or slightly obtuse, glabrous, whitish beneath. Bl.

Tellicherry, Malabar Coast.

In addition to these brief characters, the habit of the two plants is very distinct and is well preserved in the figures. Admitting therefore that the Asiatic plants are distinct from the American, they must equally be viewed as distinct from each other and may perhaps be thus defined:

A. officinalis (Lin.), leaves obovate or obovato-cuneate, coriaceous, glabrous above, glauco-pubescent beneath, peduncles axillary, solitary or sub-panicled, terminal: with several sessile capitula, or a single terminal one, bracts and lobes of the calyx coriaceous, concave, ciliate: sub-acute: corolla 4-cleft: stamens as long as the lobes, exserted: style about the length of the ovary, slightly cleft at the apex, segments acute, approximated.

A. alba (Blume), leaves oblong, elliptico-lanceolate, acute at both ends, glabrous above, whitish pulverulent beneath: peduncles terminal, from the axils of the last pair of leaves of the branches, long, slender; flowers capitate: capitula compact, many-flowered: bracts and calyx villous on the back, densely ciliate: corolla scarcely exceeding the calyx, 4-cleft; lobes acutish: stamens about half the length of the lobes, sub-incluse: ovary densely hairy on the apex; style short, 2-cleft; lobes dilated, lanceolate, spreading.

EXPLANATION OF PLATE 173.

1. *Clerodendron Siphonanthus*, flowering branch, natural size.
2. Detached corolla split open, stamens in situ.
3. Anthers, back and front views.
4. Calyx, ovary and style, natural size.
5. Calyx and ovary slightly magnified.
6. Ovary cut transversely, showing it imperfectly 2-celled owing to the two halves of the partition not cohering in the axis.
7. Ovary cut vertically, ovules pendulous from the apex of the cells.
8. A mature fruit.
9. One of the lobes detached.
10. Cut transversely showing the thick fleshy cotyledons.
11. A cotyledon detached, showing the radicle and plumule in situ.
12. Detached plumule.

EXPLANATION OF PLATE 173-b.

1. Bouchea Hydrabadensis (Wall.).
2. Lippia nodiflora (Rich.).
3. Latana Indica (Roxb.).
4. Premna latifolia (Roxb.).
5. Callicarpa Wallichiana (Walp.).
6. Spenodesme barbata (Schauer).
7. Symphorema polyandra (R. W.).
8. Congea velutina (R. W.).
9. Congea azurea (Wall.).
10. Avicennia tomentosa (Linn.).

EXPLANATION OF PLATE 174.

1. *Gmelina Asiatica* (Linn.), flowering branch, natural size.
2. Unexpanded flower-bud.
3. Flower full-blown.
4. Corolla split open.
5. Anthers, back and front views.
6. Calyx and ovary.
7. Ovary cut transversely.
8. Cut vertically, ovules pendulous.
9. Small portion of a flowering branch of Gmelina paviifolia.
10. Fruit of the same cut transversely, copied from Roxburgh's cor. plants.

These last figures are introduced to show the fruit, that of the other not being procurable at this time.

The outline figures above are analyses of Pholidia Scoparia, a species of *Myoporaceæ*, from Endlicher.

CXX.—LABIATÆ.

This is the last of the large orders of Corollifloræ we have to consider, and though the largest and perhaps the most difficult is, I believe I may safely venture to add, the best known. For this perfect acquaintance with a family so extensive, and at the same time so exceedingly natural, that in many cases it is almost impossible to define the limits of either its genera or species, we are indebted to the untiring labours of Mr. George Bentham, probably the most accomplished and indefatigable of living Botanists, who has, for nearly 20 years, been studying this order and, from year to year, as opportunities offered, amending his previous labours. In 1830 his first paper on the Indian *Labiatæ* was published in Dr. Wallich's great work, "Plantæ Asiatieæ Rariores." This was followed by the publication, between 1832 and 1836, of his Monograph of the order, including 1714 species; and lastly, in 1848, by his revision of the whole of his past labours on this family in the article *Labiatæ* of De Candolle's Prodromus, occupying 580 pages of that closely printed work, truly a great work though forming but a small portion of his numerous contributions towards the advancement of Botanical Science, among which may be mentioned, as being scarcely if at all inferior to the present, his Monograph of *Scrophulariaceæ*, another great family which he has long and carefully studied.

The order having been so admirably elaborated, it only remains for me to endeavour, to the best of my abilities, to give a summary, I fear a very imperfect one, of his labours, and recommending those desirous of acquiring a more perfect acquaintance with it to apply to the originals.

A species of this order is for the most part known at first sight, if in flower, by its general aspect. The stem is 4-angled; the leaves are in opposite pairs; the flowers form clusters in the axils of the leaves or have the appearance of a ring embracing the stem; looked at a little more closely, the calyx is found to be tubular and variously toothed on the margin: the corolla monopetalous, generally two-lipped with 2, or 4 unequal stamens, and on the removal of the corolla is seen, seated in a fleshy variously lobed gynophore in the bottom of the calyx, the 4-lobed ovary and, springing from the middle, a filiform style ending in a bifid stigma.

The ovary, when cut across, is seen to consist of 4 distinct cells with a single erect ovule in each.

It may be assumed from this description, in which every thing seems in pairs—opposite leaves, 2-lipped corolla, 2 or 4 stamens and 4-lobed ovary—that it essentially is what is called a tetramerous family, and yet such is not the case. The calyx, when analyzed, evidently consists of 5 united sepals, the corolla, in like manner, can be shown to be made up of the union of 5 petals, and often 5 stamens, one imperfect, are developed; showing clearly that, as in most of the other corollifiorous orders we have been considering, they are pentamerous. The structure of the gynæcium, or female organization, does not seem quite so clear. Regarding it, Mr. Bentham remarks, "For though monstrous flowers in *Sideritis canariensis*, *Coleus aromaticus*, *Salvia critica*, &c., have shown that the normal number of carpellary leaves forming it is five, yet in the habitual state of the Labiatæ this number is constantly reduced to two, which are placed fore and aft." I have quoted this passage for the purpose of remarking that, it seems to me to present a kind of non sequetur in our botanical logic. It is customary to assume that whatever parts are developed in an ovary, in a state of monstrosity, must be pre-existent and normal, notwithstanding something very different is, in the healthy condition, always developed. In this particular case it is stated that two carpels is the healthy condition of the plant, but that occasionally, in monsters, 5 are produced; ergo, 5 is the normal number, and the all but constantly present 2, abnormal. On opposite leaved plants, verticels of 3 or 4, or more are, in diseased or monstrous states, met with; would it in such cases be considered sound logic to infer that, because in such examples whorls did occur that therefore whorld leaves was the normal structure, not merely in the individual, but in the whole family to which it belongs? We daily see aberrations in the formation of parts both of excess and deficiency, would it be logical to infer from such cases that they only presented the normal form? I have seen cases of an excess of toes and fingers, would it be safe to infer from such that two thumbs on each hand was the normal structure of the human hand, but that generally they were reduced

to one? I think not, and neither can I reconcile my mind to all the deductions of a like kind, and they are many, to be met with in botanical writings. The study of monstrosities has been, if I may so say, the making of structural botany; but occasionally it seems possible to overshoot the mark.

On these grounds, then, I hesitate in adopting as legitimate the above deduction, that a quinary gynæcium is the normal form of *Labiatæ*, any more than that it is that of *Gentianeæ*, or any other of the dicarpellary orders we have been examining. To any one studying a labiate plant, without reference to the analogies furnished by other orders, especially the *Borragineæ* and *Verbenaceæ*, it requires a considerable stretch of the imagination to conceive how four such perfectly distinct ovaries can be the produce of only 2 carpels; while in *Ochnaceæ*, where they are scarcely more perfectly distinct, each is allowed a separate carpellary leaf. But leaving the question of 2 or 4 or 5 carpels to be settled by future inquirers, I shall now proceed with the consideration of the order in its usual form.

Character of the Order. Flowers hermaphrodite, usually irregular, calyx free, persistent, 5- rarely 4-merous, monosepalous. Corolla monopetalous, hypogynous, deciduous, 5-merous or, through the union of the upper lobes, 4-merous, irregular; æstivation bilabiately imbricate, the upper lip exterior, middle lobe of the lower inmost, lateral ones intermediate. Stamens inserted on the corolla, alternate with its lobes, the upper one, and sometimes even the upper or lateral pair aborting or altogethr wanting. Anthers various. Ovary free, seated on a gynophore or thick disk, 4-parted or rarely 4-cleft, lobes erect, attached transversely, or obliquely by the interior side, towards the base; style central, erect, between the lobes, usually bifid at the apex, the divisions anterior and posterior; ovules solitary in each lobe of the ovary, erect, anatropous. Fruit conformable to the ovary; sometimes by abortion 3- or 1-lobed, with one erect seed in each; testa thin; albumen sparing or wanting; embryo straight or rarely, in *Scutellaria*, incurved with the seed; radicle short next the hilum; cotyledons fleshy, parallel to the axis of the fruit.—Herbs or undershrubs or shrubs; with opposite or whorld 4-sided branches. Leaves opposite or whorld exstipulate, entire or divided, reticulately penninerved. Leaves and calyx in many, and in some the stems and corolla, covered with globose glands, filled with fragrant very aromatic essential oil. Inflorescence (called a thyrsus) formed of axillary, opposite, centrifugal flowering, cymes, with a terminal flower, the rest unilateral on the branches. Bracts two, opposite, under the branches of the cymes, with solitary ones opposite the flowers on the branches. Cymes heteromorphous, namely: 1*st*, normally loose, ramose, many-flowered, with the flowers unilateral along the branches: 2*d*, condensed on the apex of a common peduncle, and then called capitate: 3*d*, condensed into 2 opposite sessile fascicles, forming a false verticil or verticillaster, with the interior bracts often aborting, the exterior ones forming an involucrum or likewise aborting: 4*th*, reduced to a single flower, and then the flowers are opposite and solitary.

The verticillasters (or pairs of opposite cymes) are sometimes all axillary, uniformly seated in the axils of the cauline leaves; sometimes the upper ones are all racemose or spicate, that is, disposed on the ends of the branches in the axils of bract-like leaves. In a few species, they are spicate, or racemose, with the flowers alternate or scattered, not opposite. Benth.

Affinities. On this head there is not much room for remark, the order being so peculiar in its inflorescence and fructification that it may almost be said, if in such a case the expression be allowable, to be sui generis. In this work I followed De Candolle's series of orders down to *Gentianeæ*, but the subsequent ones appearing less naturally disposed, I felt it necessary to depart somewhat from that arrangement, in the hope of thereby obtaining a more easy flowing series; and in doing so found that the succession of orders between *Orobanchaceæ* and *Scrophulariaceæ*, both inclusive, formed a group that can scarcely be separated, each passing easily into its successor, and the whole forming a perfect circle, all held together by their irregular unsymmetrical flowers. From *Scrophulariaceæ* to *Solanaceæ* the transition is so easy that at some points it is scarcely possible to draw the line between them though, viewed as a whole, they are most readily distinguished by the irregular flowers of the one, and the regular

ones of the other. The series between *Solanaceæ* and *Borragineæ*, both inclusive, forms a a second group (but not, as in the former case, a circle) marked by their regular flowers; which again by an easy transition passes into *Verbenaceæ* through the medium of the fructification, and occasional regular flowers of the latter. "The *Verbenaceæ* alone, having frequently the same inflorescence and many of the characters of *Labiatæ*, approach near enough to occasion any hesitation in drawing the line of separation." Both orders have irregular labiate flowers, and the "ovarium is slightly lobed in *Verbena* and other neighbouring genera; and in *Cymaria* and some *Teucria*, it is less lobed than in other *Labiatæ*, but yet, the distance is considerable in this respect between the former and latter genera. Amongst the genera, in other respects intermediate, *Cloanthes* has been instanced by Mr. Brown as having the habit of *Labiatæ*, and the characters of *Verbenaceæ;* and *Hoslandia*, on the contrary, as being Verbenaceous in habit with Labiate characters: to these instances may be added the close resemblance, in all but fruit, between *Teucrium*, *Betonica*, &c., and *Vitis ovata*, *trifoliata*, &c.; but these examples present no real difficulty and are few compared with the vast extent of both orders." Benth. Lab. P. xv. To these examples must now be added *Holmskioldia*, at first referred to *Labiatæ* but now placed among the *Verbenaceæ*. From this it appears that, in a linear series such as is here adopted, this is its proper place. The transition from *Verbenaceæ* into *Labiatæ* is easy, but there is no other into which *Labiateæ* can similarly pass, the two following orders having no affinity, and appear as if placed at the end of this class, simply to facilitate the passage to the next, with the leading orders of which they have some affinity.

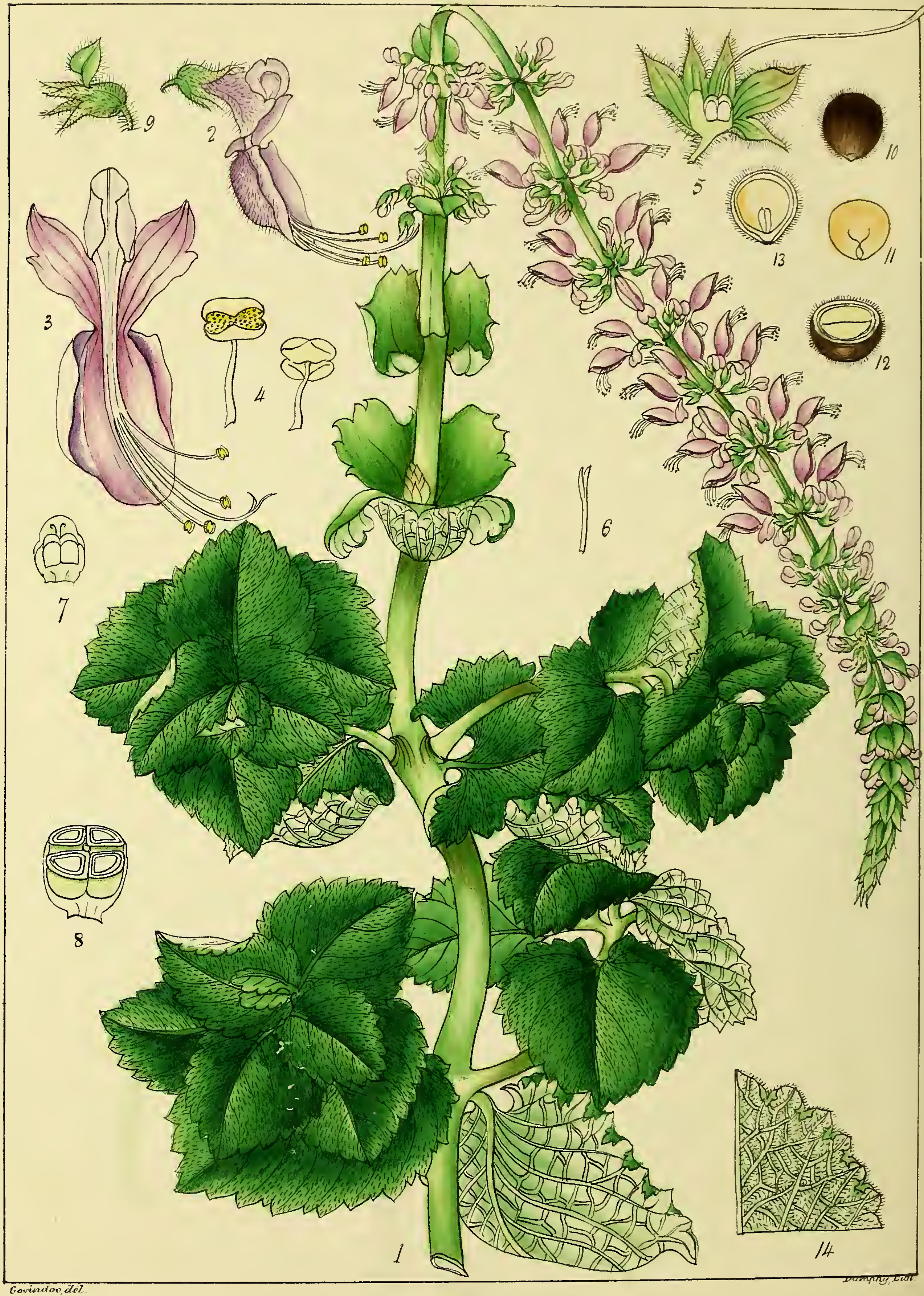
Geographical Distribution. Labiatæ are scattered over nearly the whole earth.

The following brief but comprehensive summary of their distribution I copy from Dr. Lindley's Vegetable Kingdom.

"Natives of temperate regions in greater abundance than elsewhere, their maximum probably existing between the parallels of 40° and 50° N. latitude. They are found in abundance in hot dry exposed situations, in meadows, hedgerows and groves; not commonly in marshes. In France they form 1-24th of the flora; in Germany, 1-26th; in Lapland, 1-40th; the proportion is the same in United States of North America, and within the tropics of the New World (Humboldt); in Sicily they are 1-21 of the flowering plants (Priesl); in the Balearic Islands, 1-19th. About 200 species are mentioned in Wallich's catalogue of the Indian Flora, a large proportion of which is from the Northern provinces. They are not found in Melville Island."

In Southern India they are most abundant on the tops of the higher ranges of mountains, and are very numerous, both as to species and individuals, on the Neilgherries, but many also occur on the plains.

Properties and Uses. On this branch of the subject it can scarcely be needful to dwell, their qualities not being of much consequence to mankind though many of the species contribute something to his stock of luxuries and comforts, if not necessaries. So far as yet ascertained, the order does not possess a really noxious species, but many very aromatic ones, owing to the large quantities of essential oil secreted by their glands. These essential oils, many of which are admitted into Pharmacopæia, are useful as carminatives, for expelling flatus, and often still more so on account of their agreeable aromatic flavour affording a convenient shield to cover the disagreeable taste of other more efficient medicines; such are the principle uses of the Mints, Lavenders, &c. Many are used as condiments in cooking, and some are bitter and tonic and, as such, used as strengthening medicines. But upon the whole they are generally much more highly esteemed by the domestic practitioner than by the physician. As articles of perfumery, who does not know the Lavender water and Eau-de-Cologne, both of which derive part of their scent from the Lavender; also the Rosemary, a strong infusion of which is employed to allay the heat of skin in Erysipelatous eruptions, and as a cephalic to relieve headache and excite the mind to vigorous action. "It is also remarkable for its undoubted power of encouraging the growth of hair and curing baldness. It is in fact what



Govindoo, del. Dumphy, Lith.

COLEUS AROMATICUS (LENTH)

causes the green colour of the best pomatums used for that purpose. An infusion of it prevents the hair from uncurling in damp weather." It is one of the plants used in manufacturing Hungary water. Of the Indian species, few indeed have obtained repute as medicinal agents.

Both the species selected for illustrating this order are held in repute by the Natives as medicinal agents. The one, *Coleus*, as a powerful aromatic carminitive, in cases of cholic in children; on which occasions the juice is prescribed mixed with sugar or other suitable vehicle; the other, *Leucas*, or *Phlomis*, as it was formerly called, as a very effective application in cases of pustular eruptions, for which purpose the leaves and tender tops are beat into a pulp and applied as an unguent. It is said to be a most effective remedy in Psora. Another plant of this order, *Anisomalis Malabarica (Neputa Malabarica*, Ainslie), has got the reputation of being a tonic and febrifuge; for the cure of the latter it is administered in infusion and the patients are made to inhale the vapour rising from the infusion. The infusion is also prescribed in dysenteric affections. I have not heard it from Natives that an infusion of *Coleus aromaticus* produces an intoxicating effect, but I was told by a European Lady, who had been recommended to use it as a carminitive, that it certainly produced that effect on her, and forced her to discontinue its use, though deriving benefit, towards the aleviation of the ailing, dyspepsia and frequent attacks of flatulent cholic, for which it was prescribed.

Remarks on Genera and Species. In this, as in the preceding large orders, it seems futile to attempt individualizing either genera or species, and especially in this, which has been so thoroughly elaborated by so excellent an observer. Such being the case I shall, as above, merely give the Tribal characters, accompanied by the analysis of at least one genus of each of those having Indian representatives. The following then are Mr. Bentham's tribes of this order, under which are arranged 121 genera in De Candolle's Prodromus.

Tribe I. Oceinoideæ. Stamens declinate.

Tribe II. Satureieæ. Stamens distant, straight, divaricate or connivent under the upper lip, 4 or 2 (then the anthers are 2-celled with the connective not filiform), lobes of the corolla flat.

Tribe III. Monardeæ. Stamens two, straight or ascending, cells of the anthers oblong, linear, either solitary or separated by a filiform connective, (rarely approximated.)

Tribe IV. Nepeteæ. Stamens 4, the posticous (not the anticous as in the other tribes), longer.

Tribe V. Stachydeæ. Stamens 4, ascending parallely under the usually concave helmet (galea). Nuculæ smooth or tuberculate, free from the base, erect.

Tribe VI. Prasieæ. Stamens like those of Stachydeæ. Nuculæ fleshy, sub-connate at the base.

Tribe VII. Prostanthereæ. Nuculæ (usually reticulately rugose) connate at the base. Style sub-persistent. Throat of the corolla campanulate, lobes plain.

Tribe VIII. Ajugoideæ. Nuculæ reticulately rugose, subconnate at the base, stamens ascending parallely, upper lip of the corolla either minute or cleft, lobes declinate.

EXPLANATION OF PLATE 175.

1. *Coleus aromaticus* (Benth.), flowering branch, natural size.
2. A detached corolla.
3. Corolla split open, stamens monodelphous at the base.
4. Anthers, back and front views.
5. Calyx and pistil.
6. Apex of the style and stigma.
7. Detached ovary 4-lobed.
8. Ovary cut transversely.
9. Fructiferous calyx. 10. A seed.
11. The same, testa removed.
12. Seed cut transversely.
13. Cotyledon and plumule.
14. Portion of the under surface of a leaf. All more or less magnified.

EXPLANATION OF PLATE 176.

1. *Leucas Zeylanica* (R. Br.) small plant, natural size.
2. An expanded flower. 3. Corolla split open.
4. Anthers, side and front views.
5. Calyx and ovary.
6. Detached ovary.
7. Ovary cut transversely.
8. Fructiferous calyx.
9. A nearly full-grown but immature seed.
10. A detached fruit.
11. A nut cut transversely.
12. Cut longitudinally.
13. Cotyledons detached.
14. Upper and under surfaces of the leaves. All more or less magnified.

EXPLANATION OF PLATE 176-b.

1. Anisochilus carnosus. (Wall.)
2. Lavandula Burmanni. (Benth.)
3. Salvia lanata. (Roxb.).
4. Pogostemon rotundatum. (Benth.)
5. Micromeria biflora. (Benth.)
6. Nepeta leucophylla. (Benth.)
7. Scutellaria violacca. (Heyne.)
8. Prunella vulgaris. (Linn.)
9. Gomphastemma Heyneana. (Wall.)
10. Leucas urticæfolia. (R. Br.)
11. Leonotis nepetifolia. (R. Br.)
12. Teucreum tomentosum. (Heyne.)

CXXI.—PLANTAGENACEÆ.

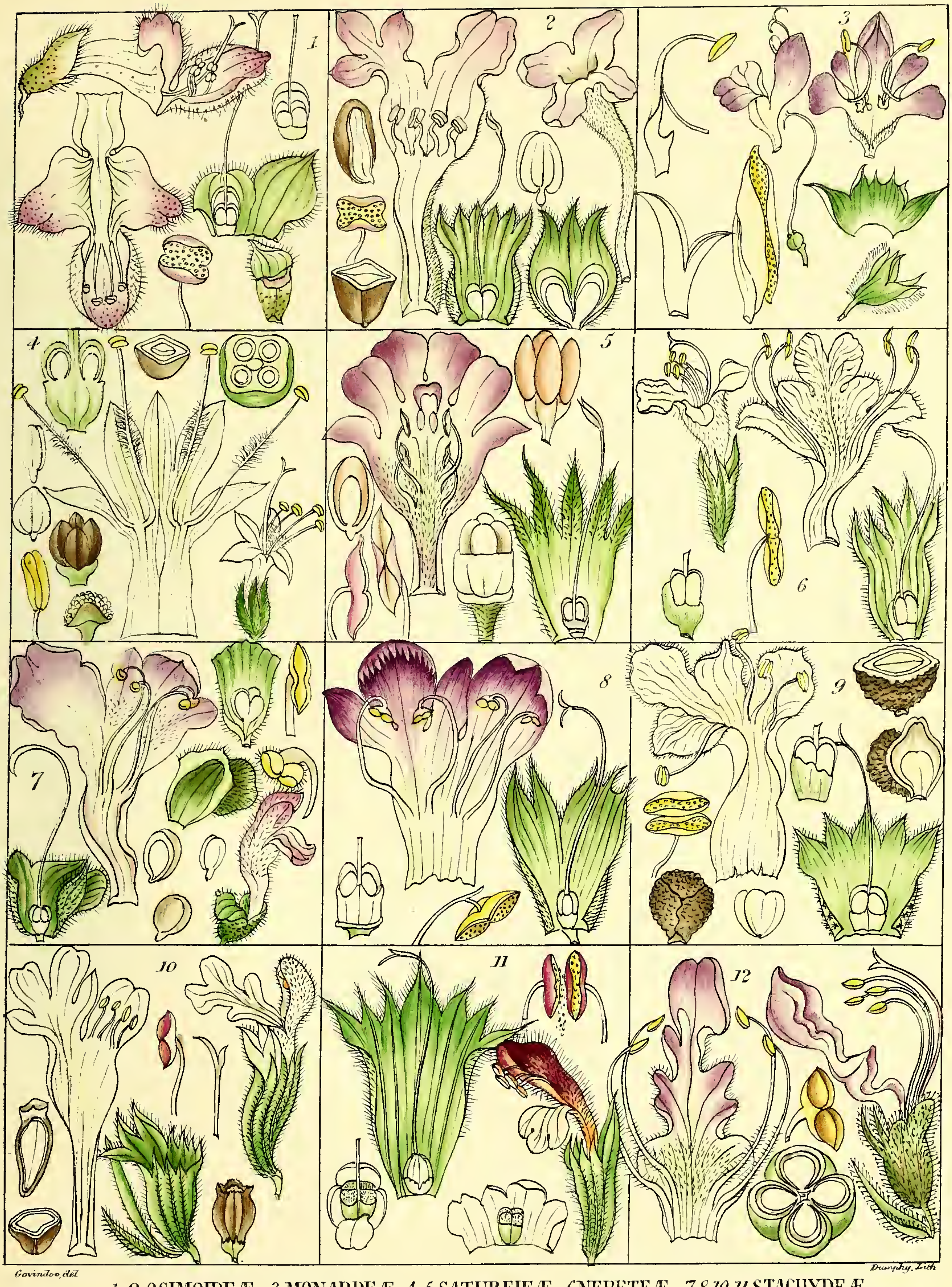
This small order, consisting of only 3 genera, but now including about 120 species, was first established by Jussieu, who, regarding what more modern Botanists call the corolla a petioled calyx and the calyx an involucrum, placed it between *Amarantaceæ* and *Nyctagineæ.* A recent writer, Barneoud, who has deeply studied the order, takes a somewhat similar view, he also viewing it as monochlamedious, but with this difference, that he calls Jussieu's involucrum a calyx and his calyx modified stamens. Neither of these views of the nature of the floral envelopes, is admitted to be correct by the generality of modern Botanists, who, almost universally acknowledge it a member of the Corolliflorous sub-class, considering the floral envelopes as truly a calyx and corolla as those of any other order. It consists of low herbaceous stemless plants, usually with the leaves all radical, forming rosettes. Some however are caulescent with opposite or alternate leaves. In Indian Botany it is an order of very secondary importance, only three or four species having yet been found in India Proper, and, so far as I am aware, only one within the limits of the Peninsula, and that confined to the highest mountains, such as the Neilgherries and Pulney Mountains and Newera Ellia in Ceylon. From the mountains in Scinde however I have received, through the kindness of Mr. Stocks, two or three species showing in the flora of that country a marked tendency towards a greater predominence of the European forms, which is confirmed by several other families, such as *Cruciferæ*, *Labiatæ*, *Orobanchaceæ*, &c., all of which present forms very distant from those of India and akin to those of Europe. The following, slightly altered, is Lindley's

Character of the Order. Calyx imbricated in æstivation, 4-parted, persistent. Corolla membranous, monopetalous, hypogynous, persistent, with a four parted limb. Stamens 4, inserted into the corolla, alternately with its segments; filaments filiform, flaccid, doubled inwards in æstivation; anthers versatile 2-celled. Ovary composed of a single [?] carpel, sessile, without a disk, 2- very seldom, 4-celled, the cells caused by the angles of the placentæ; ovules peltate or erect, solitary, twin, or indefinite; style simple, carpellary; stigma hispid, simple, rarely half bifid. Capsule membranous, dehiscing transversely, with a loose placenta bearing the seeds on its surface. Seeds sessile, peltate, or erect; solitary, twin, or indefinite; testa mucilaginous; embryo lying across the hilum in the axis of fleshy albumen; radicle remote from the hilum, inferior, or in some cases centrifugal.—Herbaceous plants, usually stemless, occasionally with a stem. Leaves forming rosettes, or in the caulescent species both alternate and opposite; flat and ribbed or taper and fleshy. Flowers in spikes, rarely solitary; usually bisexual, seldom, by abortion, with the male and female in separate flowers.

Affinities. These are generally admitted to be obscure and my acquaintance with the order is too confined to admit of my offering any decided opinion on the subject. As already remarked, Jussieu and Barneoud consider it monochlamedious, a position from which Botanists

Govindoo, del. Dunphy, Lith.

LEUCAS ZEYLANICA (R.Br.)



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1. 2. OCIMOIDEÆ. 3. MONARDEÆ. 4. 5. SATUREIEÆ. 6. NEPETEÆ. 7. 8. 10. 11. STACHYDEÆ. 9. PRASIEÆ. 12. AJUGOIDEÆ.

Govindoo del. Dumphy Lith

PLANTAGO ASIATICA (LINN)

generally dissent. As regards the genus *Plantago*, I am disposed to coincide with Don and Lindley, in considering it more nearly allied to *Primulaceæ* than to any other, by its agreeing in so many points with the ovary and seed of that order. Endlicher and others consider it more nearly allied to *Plumbagineaceæ*, on account of the texture of the corolla, but it wants one essential characteristic of both these orders; the stamens are alternate not opposite the segments of the corolla, as in *Plumbagineaceæ* and *Primulaceæ*, while as regards the structure of the ovary and seed it is most distinct from the former but nearly agrees with the latter, so that in place of being, as stated by Endlicher, far removed from *Primulaceæ* it only differs in the position of the stamens. And the value of even that solitary distinction seems weakened by the singular fact, noticed by Mr. Brown, that in most of the species the divisions of the tube caused by the swelling of the fruit are alternate with those of the limb, which seems to imply that the true lobes are split down the middle and the apparent ones each made up of 2 halves, in which case the stamens are actually opposite the lobes, as in *Primulaceæ*. If this view of its structure can be established, it will follow that its true station is next that order, with which it further agrees in habit and scapoid inflorescence.

Lindley, following Endlicher, assigns, without a doubt or qualification, in the character of the order, a 2-celled ovary composed of a single carpel, the cells being caused by the angles of the central free placenta abutting against the sides. I have endeavoured to make out this structure, but not successfully. The ovary is 2-celled and, as it appears to me, the partition is formed in the usual way by the introflexed margins of 2 carpels meeting in the axis and there forming the placenta. In this I may be wrong as the parts are very minute, requiring both skill and delicacy in the dissection, but such is the appearance they present to me. It results, if my dissections are correct, that the opinions of Endlicher and Lindley, as to the ovary being composed of a single carpel, must be wrong, and so must my view of its affinities. Analogy is in favour of their opinion, so far as the freedom of the placenta is concerned, but not, I think, as regards the solitary carpel. With this remark I leave the question to be decided by those more skilled in minute anatomy than I am but, on the supposition that it is dicarpellary, place the order between *Labiatæ* and *Plumbagineæ*, as being its nearest relations.

Geographical Distribution. Generally speaking, this is an extra tropical order, for, though met with in the tropics, the species that occur within that zone, are nearly confined to alpine stations where they enjoy a temperate climate. I have only recognized one species on the Neilgherries, but there may possibly be others which I have overlooked. The one here figured is very common on these Hills; less so, if indeed it be really the same species, of which I have some doubts, on the Pulney Mountains. Three or four have been found on the Himalayas, but probably, if carefully sought for, more would be found. From Scinde, as already mentioned, I have received three or four species.

Properties and Uses. These are not important, slight bitterness and astringency are found in the herbaceous parts of the plant, which have led to their employment in Europe in domestic medicine. And one species, *Plantago Ispaghula*, is cultivated in some parts of India, for the sake of the seeds, from which a mucilaginous emollient drink is prepared and prescribed, by both European and Native practitioners, in cases of cough, ardor urinæ, and other affections requiring emollients.

EXPLANATION OF PLATE 177.

1. *Plantago Asiatica* (Linn.), a smallest plant, natural size.
2. An expanded flower with its bractea.
3. Corolla detached.
4. Split open, showing the attachment of the stamens.
5. Anthers, back and front views.
6. Calyx and ovary.
7. Ovary, cut transversely. 8. Vertically.
9. Full-grown capsule.
10. Cut vertically to show the placenta and partition.
11. Capsule after dehiscence. 12. A seed.
13. Cut transversely.
14. Longitudinally, showing the embryo in situ.
15. Embryo detached. 16. Capsule dehiscing.

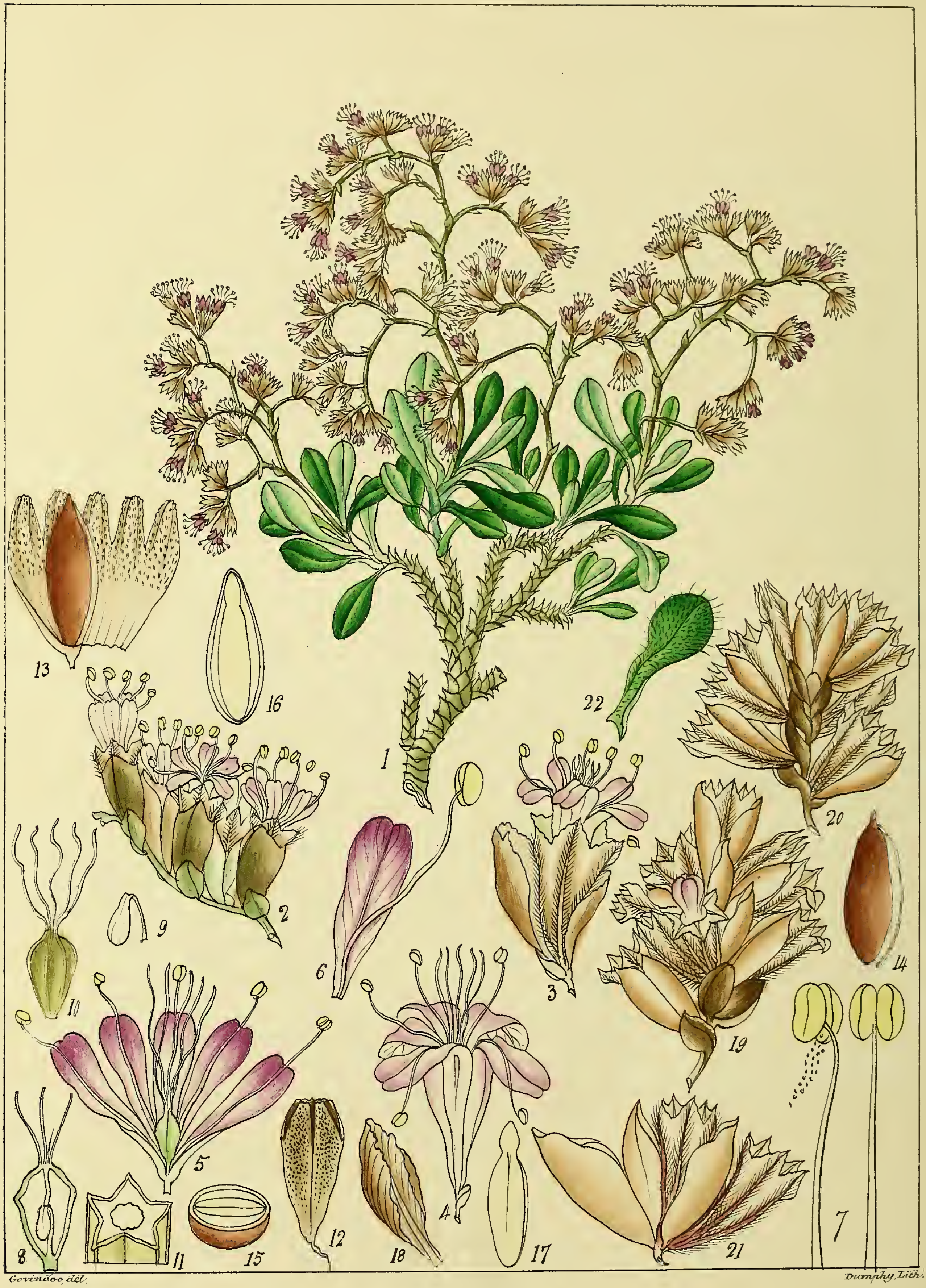
CXXII.—PLUMBAGINACEÆ.

This is a small order and one with which the Indian Botanist has but little trouble, the Indian species being very few. Of ten genera, referred to the order, only three have Indian representatives, and among them only furnish four species. Scinde and Cabul have several more, some of which it seems probable may be found eastward of the Indus but as yet, so far as I can discover, none of them have been found in our North Western provinces. The Scinde and Cabul ones belong to that most difficult genus, *Statice*, for specimens of one species of which I am indebted to Mr. Stocks. The order, being thus sparingly distributed in India, need not occupy much of our time or space. A most elaborate Monograph by M. E. Boissier has recently been published in De Candolle's Prodromus, but which, so far as this work is concerned, seems unnecessarily detailed and copious, especially in the character of the order which occupies three pages of that work.

Character of the Order. Calyx tubular, persistent, sometimes coloured, corolla (of very thin texture) monopetalous, with a narrow tube, or composed of 5 petals, which have a long narrow claw. Stamens definite, opposite the petals, in the monopetalous species hypogynous [in Plumbago seated on the very bottom of the corolla but not truly hypogynous], in the polypetalous rising from the petals. Ovary superior composed of 5 (or 3 or 4) valvate carpels, 1-celled, 1-seeded; ovule anatropal, pendulous from the point of an umbelical cord arising from the bottom of the cavity; styles 5! seldom 3 or 4; stigmas the same number. Fruit a nearly indehiscent utricle. Seed inverted with a rather small quantity of mealy albumen; testa simple; embryo straight; radicle superior.

Affinities. On this point considerable difference of opinion for some time existed, and of a kind suited to give rise to a curious question, one, apparently, easily answered, but in reality a very difficult one, namely, how to distinguish the calyx from the corolla. Jussieu, and afterwards De Candolle, considered the part here called the calyx a kind of involucrum, and the petals as a perianth or calyx. Mr. Brown adopted the opposite opinion and pronounced the so called involucrum and calyx a real calyx and corolla, not apparent, and consequently that these plants did not belong to the monochlamedious class. Admitting that this view is correct, that the stamens are opposite the petals, that the ovary has 5 carpels, but is only 1-celled with a central free placenta (for such, I presume, the long filiform funiculous from which the ovule is suspended may be considered), then the relationships of the order seem evidently to lie in my first group (see page 127). But if, on the other hand, Jussieu's idea is adopted, which views the corolla as a calyx, then the order is transferred to a different class and may indeed be viewed as the transition order. In regard to the position of the stamens, which must have some weight in deciding this question, I find that, in *Statice*, they are inserted on the petals as in the Myrsincous group, but in *Plumbago*, they have a glandular enlargement at the base of the filaments by which they cohere, forming a ring round the base of the ovary, but are perigynous, that is inserted on the base of the part called corolla, not hypogynous, and have the filaments opposite the lobes. These facts go far to throw doubt on the correctness of Mr. Brown's opinion, and to leave this still an open question. Lindley remarks that they are distinguished from all the monopetalous orders by their plicate calyx, and Brown commences his definition of Plumbago with the words, "calyx plicatus." As applied to *P. Zeylanica*, I do not understand the meaning of the term. Fresh flowering specimens are now before me, but they present neither plait nor fold, I therefore attach less weight to that mark of distinction than to the very unusual one of the ovule being suspended from the apex of a cord which rises from the base of the cell, a peculiarity, to the best of my recollection, not elsewhere met within this sub-class, and forming an admirable point of structure by which to associate, as one family, nearly all plants in which it occurs.

Geographical Distribution. "In toto orbe terrarum occurrunt;" such are the few but comprehensive words of the M. Boissier in regard to their distribution in general.



Govindoo del. Dumphy, Lith.

STATICE STOCKSII (BOISS.)

The *Statices* and *Armerias* are partial to the coast and salt marshes, in such situations extending from Greenland to within the tropics. *Plumbago Zeylanica* extends from near the foot of the Himalayas to Cape Comorin, Ceylon, and Port Jackson in Australia. *Ægialitis*, in like manner, extends from the Sunderbunds of the Hoogly to Australia; and *Vogelia* has now 3 species respectively named, *Africana*, *Arabica*, and *Indica*.

Properties and Uses. These, so far as yet known, are not important, but I find it currently believed in this country, that the roots of *Plumbago Zeylanica*, reduced to powder and administered during pregnancy, will cause abortion; and made into a paste with a little congee, and applied to the skin, will produce a blister; whence it is used as a discutiant in incipient and indolent Buboes. *Plumbago Europæa* is said to be still more energetic, causing ulcers when applied to the skin, and vomiting and catharsis when taken internally. Some species of *Armeria* are employed in European domestic medicine as diuretics, and with considerable effect.

Remarks on Genera and Species. On this subject I have nothing to offer. The two species of *Plumbago* known in India, *P. Zeylanica* and *P. rosea*, are best distinguished by the colour of their flowers, white in the one and red in the other. *Vogelia* is known at first sight by the sepals, which are lanceolate with a strong midrib, and thin membranous crisped margins. In regard to the fecundation of the ovule, I quote the following paragraph from Lindley.

"The economy of the ovule is highly curious; before fecundation it is suspended from the apex of a cord or rather strap which lies over the foramen, or orifice of the foramen, through which the vivifying influence of the pollen has to be introduced; this foramen is presented to the summit of the cell immediately below the origin of the stigmas, but has no communication with that part of the cell, from contact with which it is further cut off by the overlying strap; but as soon as the pollen exercises its influence on the stigmas, the strap slips aside from above the foramen which is entered by an extension of the apex of the cell, and thus a direct communication is established between the pollen and inside of the ovule.

"This phenomenon is obscurely hinted at by several writers, but was first distinctly shown me by Dr. Brown, and has since been beautifully illustrated by Mirbel, *Nouvelles Recherches sur l'ovule*, tab. 4."

After writing the above, and when comparing the drawing with the character of the order, it seemed not to convey a sufficiently perfect idea of the order as a whole; the appearance and general habit of the first section, *Staticeæ*, differing so greatly from the second, *Plumbageæ*. To obviate this defect I have thought it advisable to give a figure illustrative of that section also. And have selected for the purpose a species, a native of Scinde, hitherto unfigured, at least under the name here given. The compliment is well merited, Mr. Stocks being a most indefatigable and excellent Botanist, but I do not feel by any means certain that this will be retained as a distinct species, it seems so very nearly allied to *S. Arabica*. M. Boissier's specific characters, like those of his ordinal one, are full to complexity, and on comparing what I esteem authentic specimens of the species, with the character, cannot help thinking there is some mistake, either in the phrase or specimen; the analyses therefore are given in much detail, especially as regards the parts concerned in the specific character.

EXPLANATION OF PLATE 178.

1. *Statice Stocksii* (Boiss.), flowering branch, natural size.
2. Portion of a spike.
3. Detached spikelet consisting of a full-blown flower and unopened bud. 4. Detached corolla.
5. Corolla opened showing the ovary.
6. Detached petal and stamen. 7. Detached stamens.
8. Ovary cut longitudinally, showing the cord for conveying fertilizing matter to the ovule descending from the apex, and the very young unimpregnated ovule suspended from the apex of a longish funiculus in the bottom of the cell. 9. Ovule and funiculus detached.
10. Immature fruit. 11. Cut transversely, 5-angled.
12. Capsule and included seed.
13. Capsule opened, seed in situ. 14. Detached seed.
15. Cut transversely. 16. Cut vertically.
17. Detached embryo.
18. A leaf a little magnified. 19. A bract.
20. Portion of a spike seen from above.
21. Seen from below.
22. A detached spikelet of 3 flowers, one still enveloped in its bract.

Obs. It appears from figures 2 and 22 that the spikelets go on elongating from 1 to 3 or perhaps more flowers, whence I should infer, their number being fluctuating, that they are unsuitable for giving specific characters. Bossier, however, I find, frequently introduces the number of flowers on the spikelets into his characters. In this species the spikelets are described "spiculis bifloris in spicas brevissimas fasciculiformes confertis."

EXPLANATION OF PLATE 179.

1. *Plumbago Zeylanica* (Linn.). Flowering branch, natural size.
2. Detached flower with its bract and 2 bracteols.
3. Corolla split open with the stamens attached to a thickened vein at the base.
4. Detached stamens.
5. Calyx and ovary.
6. Apex of the style and stigmas.
7. Ovary cut transversely.
8. Cut vertically.
9. Detached ovule.
10. Fructiferous calyx and withered flower.
11. Same opened to show the capsule.
12. Capsule after dehiscence.
13. Detached seed.
14. Cut transversely.
15. —— longitudinally, embryo in situ.
16. Detached embryo.
17. Portion of the rachis of a spike.
18. Portion of the calyx showing the glandular hairs.
19. A gland.
20. Portions of a leaf. All more or less magnified.

CXXIII.—ERYCIBEÆ.

This order consists of only one genus and 7 species, it is however a curious one in its structure, and its affinities are still very obscure, I may almost say, unknown. In some particulars, such as the æstivation of the corolla, its 4 erect ovules, corrugated cotyledons and mucilaginous albumen, it approaches *Convolvulaceæ;* but it wants the style, and dicarpellary ovary of that order; in place of which, as shown by its 5 stigmas, it has a 5 carpellary one, but only one cell, and 4 ovules. The following graphic character of the order and genus, and remarks on its affinities, are from the accurate pen of Alphonse De Candolle, who examined the flowers with much care, and which I substitute for the character of the order as given by his father.

"I have not seen the fruit, but in dissections of the flowers, principally younger ones, I have observed the following: Calyx lobes quincuncial in æstivation. Corolla deeply 5-cleft, three times longer than the persistent calyx; lobes large, obcordato-bifid, sericeous on the middle of the back, the sericeous part triangular, externally valvular in æstivation, with the margins folded inwards mutually adpressed, crenulate, glabrous, whence the æstivation is properly enduplicato-valvate. Stamens inserted on the tube of the corolla, anthers incluse, longer than the filaments, lanceolato-subulate, cordate at the base, quickly dehiscing longitudinally; pollen ellipsoid. Nectary none. Ovary ovoid-cylindrical, glabrous, 1-celled, somewhat thicker above, surmounted by a hat-like stigma. Stigma fleshy, 10-striated or costate, costæ equal, or alternately unequal, the larger ones in that case opposite the lobes of the calyx, all subobliquely radiating towards the left. Ovules constantly 4, attached to the bottom of the ovary, erect, anatropous, obovoid, filling the cavity of the ovary. Vestiges of cells, or rather ? of filiform pollen tubes, descending from the upper part of the ovary above and between the ovules towards the base.—Four ovules with 5 or 10 stigmas, and therefore 5 carpel-leaves, is opposed to both theories of the origin of the ovules." Fruit a 1-seeded berry, cotyledons corrugated with mucilaginous albumen between the folds.

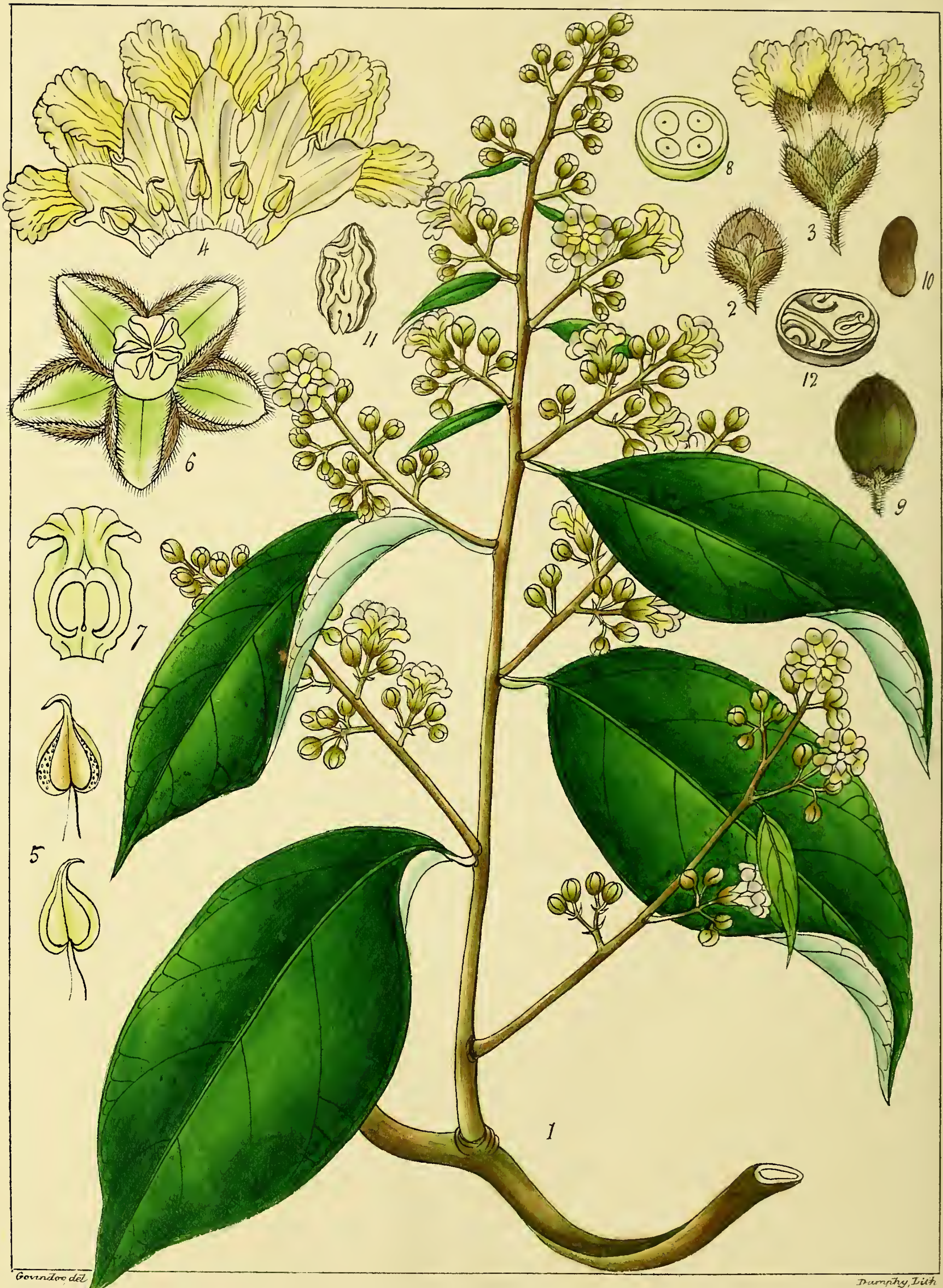
Regarding the affinities of the order he remarks—

"It differs from *Convolvulaceæ*, not by the baccate fruit, as remarked by my father, because in that order the fruit is sometimes baccate, but by the absence of a style and the quinary radiating stigma, as in *Papaveraceæ*, and especially by the one-celled ovary. For the genera of Convolvulaceæ, which are sometimes said to be one-celled, are in truth, at the period of expansion of the flower, 2-celled, as I have seen in *Porana* and *Shutereia* (Hewetia W. and A.) and only become 1-celled at maturity when the partitions and aborted ovules can still be seen under the lens. The symmetry between the ovules and carpels is present in *Convolvulaceæ* and *Cordiaceæ*, while in *Erycibeæ*, as just stated (and I have dissected more than 20 flowers), it is wanting. The æstivation of the corolla is similar to that of *Convolvulaceæ*, where it is enduplicate with the backs of the lobes more or less contorted, but it is very different from that of the *Cordias*. The structure and evolution of the ovules, whence originates the inferior radicle, indicate a difference, between *Cordia* and other *Borragineæ*, of considerable moment. The calyx, ovary, and erect anatropous ovules, call to mind the genus *Monotheca* of *Theophrastacea*, but in the æstivation of the corolla, the insertion of the stamens, and the number of ovules, they greatly differ."

வெள்ளைசித்திரமூலம்.
Vellay-Chittera-moolum } Tam:

Tel. { తెల్లచిత్ర మూలం.
Thella-chittramoolum

PLUMBAGO ZEYLANICA (LINN)



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ERYCIBE PANICULATA (ROXB)

Affinities. The above remarks leave little room to doubt that the affinities of this order do not appertain to either *Convolvulaceæ* or *Borragineæ*, neither does the author of them seem disposed to adopt his own suggestion as regards *Theophrasteæ.* Lindley, without assigning any reason, refers the genus without doubt to *Ebenaceæ*, a location in which, to me, it appears greatly misplaced. There is another family presenting a somewhat similar discrepancy, and to a much greater extent, between the carpels and ovules, which, by analogy, may aid in throwing some light on this one, I allude to *Plumbagineæ*, which, as indicated by the number of stigmas and valves of the capsule, has five carpels, and only one ovule. In *Semicarpeæ* also a similar discrepancy occurs, 3 carpels and 1 ovule. These examples seem to show that the want of correspondence in this case between the carpels and ovules, however inexplicable, is not without analogy. In *Plumbagineæ* only one of 5 carpels seems to bear an ovule; in *Erycibeæ*, on the other hand, four are fertile, and only one sterile. In many pentandrous genera we find 1 or more stamens suppressed. In *Oleaceæ* and *Jasmineæ*, there is reason to believe that two and three stamens are respectively suppressed in each, and in *Compositæ* the two carpels only produce one seed. On these premises I can scarcely admit, with Alph. DC., that the want of one ovule in this family is more opposed to the theories of the origin of the ovule than those cited. When we can satisfactorily account for the constant suppression of from 1 to 3 stamens in *Scrophulariaceæ*, *Labiatæ*, *Bignoniaceæ*, &c., we may equally be able to account for some carpels failing to bear ovules; but in the mean time must be content to take things as we find them, and view the order under consideration as one having analogies but, owing to this departure from the usual formation of so essential an organ as the ovary, no ascertained positive affinities. Under this impression I have thought it better for the present to remove it from the series of dicarpellary orders, which it tends to break, and place it beside *Plumbagineaceæ* and *Salvadoraceæ*, until a more suitable station is found for it.

Geographical Distribution. The seven species composing this order are all of Asiatic origin. Three are natives of India Proper, the other four from the Tenasserim Provinces and Eastern Islands.

Properties and Uses. On this head I am not aware that any thing is known.

EXPLANATION OF PLATE 180.

1. *Erycibe paniculata* (Roxb.), flowering branch, natural size.
2. An unopened flower-bud.
3. Expanded flower.
4. Corolla split open, showing its peculiar 2-cleft lobes, which are inflexed in æstivation, and stamens in situ.
5. Anthers, back and front views.
6. Calyx and ovary with its 5-lobed stigma.
7. Ovary cut vertically.
8. Ovary cut transversely.
9. Mature fruit about the natural size.
10. A seed perhaps a little reduced, but, being taken from a dried specimen, that is uncertain.
11. Kernel, testa removed to show the corrugated cotyledons and inferior radicle.
12. A seed cut transversely.

These, with the exceptions mentioned, are all more or less magnified.

CXXIV.—SALVADORACEÆ.

This order, if such it prove to be, consists of a single genus and two or three species. But though in structure, apparently the most simple, it is not found to associate with any of the existing monopetalous orders. As regards the calyx and corolla it seems to approach *Plantago* but with respect to the ovary, fruit, and seed, it is most remote. As regards them, it approaches more nearly to *Plumbagineæ*, but is still too distinct to allow of its admission into that order, this having no style, a sessile anatropous ovule, exalbuminous seed and inferior radicle, in all of which points it differs from *Plumbago*, having, moreover, the stamens alternate with the lobes of the corolla, and baccate fruit. In my conspectus at the head of the corolliflorous sub-class I placed it, on account of its 1-celled ovary and basal ovule, in the first group, but mentioned that I did not think its affinities lay with that group. I am still of the same opinion, and therefore place it, with *Erycibeæ*, at the end of the series, until a better place can be found

for it. Lindley, who was the first to view this as a distinct order, at first supposed it related to *Plumbagineaceæ* and *Plantagineaceæ*, a view which has been adopted by both Endlicher and Meisner, but which further consideration has led him to modify, and now he thinks it may possibly be considered an ally of *Ehretiaceæ* and *Verbenaceæ.* I quite agree with him in esteeming its relationship to the two former orders remote, and think that its suggested relationship to *Verbenaceæ* seems to merit consideration, though it must be admitted that that too is remote. For myself I feel disposed to look upon *Azimaceæ* as its nearest relation, from which it principally differs in its bisexual flowers and one-celled ovary; both are tetramerous; both have a sessile stigma; both have erect anatropous ovules; both have baccate fruit; both exalbuminous seed and inferior radicle; and both are fruticose with opposite more or less succulent leaves. On these grounds it occurs to me that, had I now to go over the ground again, I should feel disposed to place this order in the Oleinous group, as being the one with which it coincides in the greatest number of points; though I should still view it as quite distinct. Lindley, doubtfully, indicates a similar relationship, but places the order in his Echial Alliance next *Jasmineæ*.

As Lindley is the only author who has treated of this order in detail, and as his account of it is both correct and brief, I shall take the liberty of quoting it at length, for the benefit of those of my readers who may not be so fortunate as to have access to the valuable original from whence I copy it.

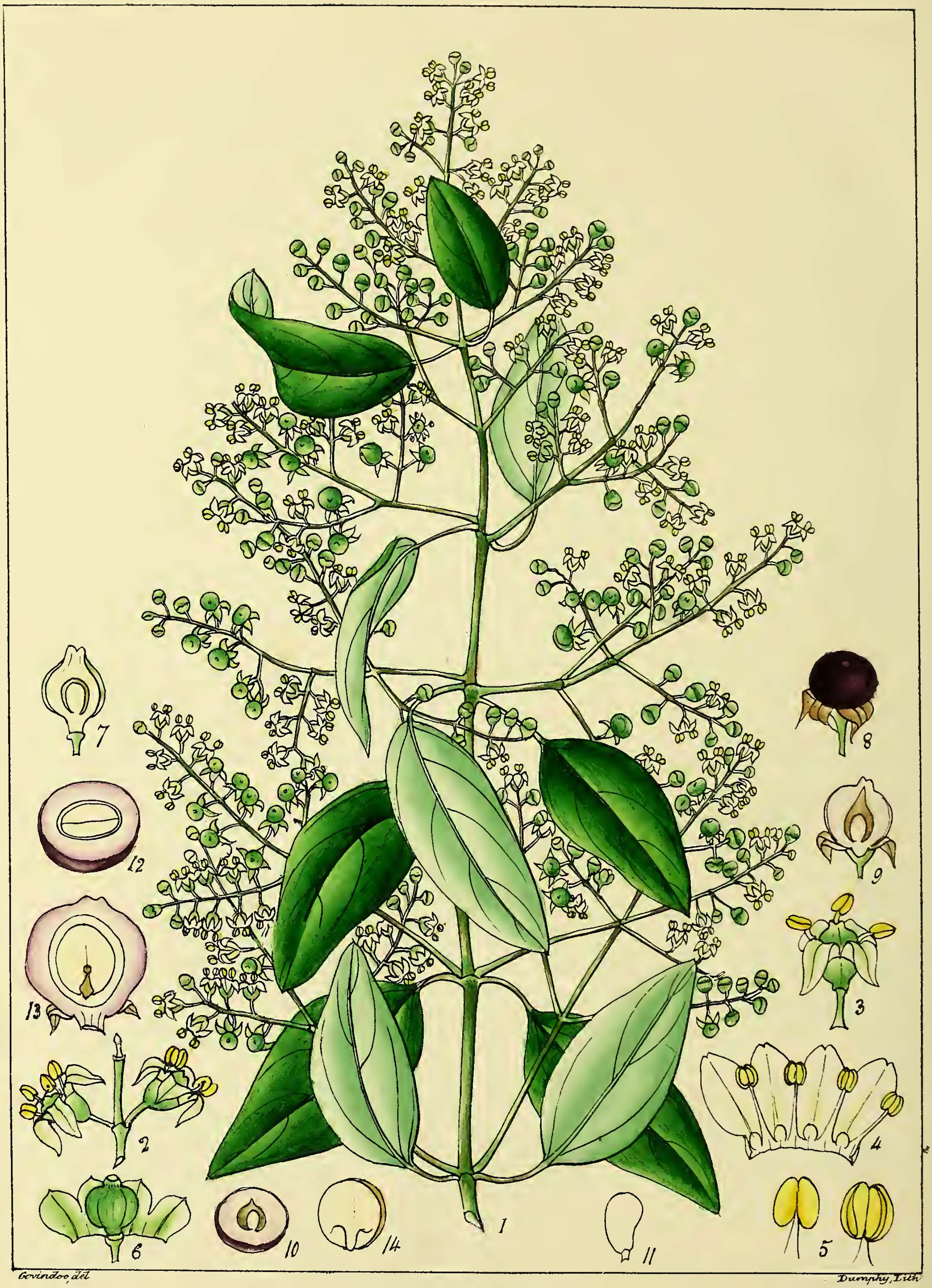
Character of the Order. "Small trees with the stem slightly tumid at the articulations. Leaves opposite, leathery, entire, very obscurely veined. Flowers minute, in loose panicles. Calyx inferior, 4-leaved, minute. Corolla membranous, monopetalous, 4-parted. Stamens 4, connecting the petals into a monopetalous corolla; anthers round, 2-celled, bursting longitudinally. Ovary superior, 1-celled, with a single sessile stigma; ovule solitary, erect. Pericarp berried; 1-celled, indehiscent. Seed solitary, erect. Embryo amygdaloid, without albumen; cotyledons fleshy, plano-convex, fixed a little below their middle to a long axis, the radicle of which is inclosed within their bases.

Affinities. "By one author referred to Chenopods or Amaranths, notwithstanding its monopetalous corolla and embryo; by another to Ardisiads, notwithstanding the position of its stamens and the structure of ovary and seeds. This plant appears to be in reality the type of a quite distinct order, the true relation of which I formerly supposed to be with Leadworts and Plantains. With the latter it agrees in the number of the parts of its flower, its membranous corolla, and simple style; with the former more in habit, and especially in the leaves, which are much like those of a Statice. It, however, differs essentially in its polysepalous calyx, amygdaloid embryo, opposite leaves, and berried pericarps. In habit it agrees with *Galenia*, and this has probably been the cause of its having found its way to Chenopods. It seems however possible, upon the whole, that it should be considered an ally of Ehretiads or Verbenes having but one carpel and symmetrical tetrandrous flowers.

The species are found in India, Syria, and North Africa.

"*Salvadora persica*, the Mustard-tree of Scripture, as has been demonstrated by Dr. Royle, has a succulent fruit which has a strong aromatic smell, and tastes like Garden cress. The bark of the root is remarkably acrid; bruised and applied to the skin it soon raises blisters, for which the Natives of India often use it. As a stimulant it promises to be a medicine of considerable power. The leaves of *S. Indica* are purgative; the fruit is said to be eatable." The berries, which are about the size and, when ripe, somewhat resemble a small red currant, have a pungent taste and the peculiar flavour of Nasturtum or Indian cress, *Tropæolum majus.*

Remarks on Genera and Species. To this genus, six species are assigned in botanical works; *S. persica*, *capitata*, *biflora*, *Surinamensis*, *paniculata*, and *Indica*. Of these the first constitutes the original type of the genus, the second and third, so far as I can make out from description, do not belong to it, the fourth rests on the authority of Sprengel, and has been referred, by Alph. D.C., to *Weigeltia*, a genus of *Myrsineaceæ* ; and lastly the 5th and 6th seem to be the same or very nearly allied species. The first and last have long been confounded. The first notice to that effect, I find in Raemer and Schultes in these words, "Planta Roxbur-



SALVADORA INDICA (R.W.)

ghi alia videtur quam illa Forskali ex descriptione." Royle afterwards took the same view and called the one *S. Persica*, the other *S. Indica*, but without giving distinctive characters. He however, as I understand him, calls, perhaps by mistake, the Indian plant figured by Roxburgh, *S. Persica*, and the Forskalian one *S. Indica*. As I happen, through the kindness of Mr. Stocks (who sent me specimens of the Western plant from Scinde), to have both species before me, I am enabled to clear up the doubts and uncertainties which have so long hung over them. The typical forms of the two plants may be distinguished at a glance, the Western or Persian one having long narrow elliptico-lanceolate leaves, and compact spicato-panicled inflorescence, or, in other words, a sessile flowered panicle; while the Eastern or Indian one, has broad ovato-oval obtuse leaves, and large diffuse racemoso-panicled inflorescence, that is, pedicelled flowers on the floriferous ramuli. The berries, moreover, of the Persian plant are described as yellow or black, those of the Indian one are red. I now have specimens of the Indian form, from both Cambay and the Circars, and thence extending South to within a few miles of Cape Comorin (how far North it goes I am unable to say), and every where corresponding with Roxburgh's figure and description. To this species, therefore, I restrict the specific name *Indica*, to the other, or long narrow leaved and sessile flowered form, I assign the specific name of *Persica*.

But I have a third nearly intermediate form, also from Scinde, which, being only in fruit, I am as yet uncertain how to dispose of. It has the broad short blunt leaves of the Indian plant, but the panicles are much more compact, and the pedicels scarcely half the length. It seems a distinct species. The above species may be thus defined :—

Salvadora Persica (Linn. *Cissus arborea*, Forsk.), leaves oblong, narrow elliptico-lanceolate, succulent, glabrous: panicles terminal, compact: flowers sessile, bracteate: bracts caducous: corolla persistent: fruit ——. Scinde, Arabia, Persia, Egypt.

Salvadora Indica (Royle? R. W., *Salvadora Persica*, Roxb.), arboreous, leaves broad ovate-oval, obtuse, glabrous: panicles terminal and axillary, diffuse; flowers longish pedicelled: bracts sub-persistent: berry about twice the length of the calyx, red, embraced by the marcessant corolla.

India, everywhere in low lying damp ground, usually near cultivation.

Salvadora Stocksii (R. W.), leaves ovato-oval, mucronate: panicles compact, terminal: flowers short pedicelled: corolla deciduous: fruit three or four times the length of the persistent calyx.

Scinde, Stocks. I consider this a perfectly distinct species, as shown by the deciduous corolla, large size of the fruit, and compact form of the panicles. In these definitions I have limited myself to the characters simply required to distinguish one species from the other. Of the two last I shall give figures in the Icones.

EXPLANATION OF PLATE 181.

1. *Salvadora Indica* (R. W.), flowering branch, natural size.
2. Portion of a raceme with 2 flowers.
3. A detached flower.
4. Corolla split open, showing the attachment of the stamens and a small gland-like scale (abortive stamens?) between each pair.
5. Anthers back and front view.
6. Calyx and ovary, the latter some days after fertilization.
7. Calyx cut vertically, showing the solitary ovule.
8. A ripe berry.
9. 10. The same cut vertically and across, showing the seed aborted.
11. The aborted seed.
12. A fertile fruit cut transversely, showing the seed filling the whole cavity.
13. Cut vertically.
14. A single seed, lobe and radicle.

POSTSCRIPT TO ASCLEPIADEÆ.

An unlooked for occurrence caused some of the preceding articles to be written more hurriedly than was quite consistent with careful study of the subjects to which they refer. Asclepiadeæ was one of these. Owing to that circumstance I was at the time of writing prevented satisfying myself of the accuracy of some former observations, regarding which I felt somewhat doubtful. Since the article passed through the press, I have been permitted to return to the subject, and now think it advisable to add a brief Postscript appertaining to the tribe *Periploceæ.*

The investigation of the pollen of the members of this tribe is by far the most difficult of the order, but fortunately, an exact knowledge of this part of the organization does not seem so indispensable to the discrimination of its genera, as in the other tribes. In some of the genera I find the pollen loose and granular, even in the anther of the flower-bud, in others it is coherent in the anther but, about the time of expansion of the flower when the anther cells open, it loses its cohesion and becomes attached to the corpuscule in a loose granular form; while in others, as *Hemidesmus* and *Brachylepis* it still presents the form of masses after they have left the anther cell. The circumstance of so many presenting granular pollen after the expansion of the flower, combined with the difficulty of examining it in the early stages of the flower-bud, lead me to the conclusion that an exact knowledge of this part of the organization is less necessary in the limitation of the genera of this tribe than in those of the others. I have not a genuine species of *Periploca* to examine to ascertain how it is in that genus, but infer, from the circumstance of Decaisne having transferred one of my Streptocaulons to it, that it is the same in both. *Finlaysonia* I have examined, but scarcely feel satisfied with the result, as regards the pollen, but in all other points it comes so near my *Streptocaulon* that I now suspect the latter ought to be reduced and its species referred to the former genus.

As already remarked, Decaisne, following Falconer, however, has transferred one of my species of *Streptocaulon* to *Periploca.* To this transfer I, with all defference, beg leave to demur, unless they take the rest along with it, and at once reduce my genus. To this I should not object, as I now think the two genera too nearly allied. *Streptocaulon* was, in the first instance, constituted to receive a number of Asiatic plants only differing from *Periploca* in having glabrous anthers; those of *Periploca* being surmounted by a dense tuft of hair. The genus therefore essentially rests on these two circumstances—Asiatic origin and glabrous anthers—Periploca claiming European or African origin, and having hairy anthers.

These characters I do not now think entitled to generic value, and believe that the species of both genera might all be associated under one (with the aid of a section), but so long as *Streptocaulon* retains a place in the botanical system, I hold that *S. calophyllum* must remain with it, at all events, cannot be transferred to *Periploca*, as its admission into that genus breaks down the only characters by which the two are kept distinct, being an Asiatic plant and having glabrous anthers.

I regret not having a specimen of *Periploca græca*, the type of the genus, with which to illustrate my position by giving a figure of it side by side with *Strept. calophyllum*, to show by contrast the difference, but to compensate as far as I can, I give, in an additional plate, generic analyses of that plant and of two species of *Streptocaulon*, examined by Decaisne and retained by him in that genus, which will show that there is no difference between them and the excluded one; and in lieu of original dissections, I copy some parts of Lamark's analysis of *P. græca.*

Having still some room left, I have, in the hope of rendering that supplementary plate more useful, introduced dissections of some other genera of this tribe. These are all more or less perfect, but rather too crowded, being anxious to illustrate as many genera as I could within the small space at my disposal. The subjects introduced into that plate are: three species of *Streptocaulon*, *Periploca græca*, *Finlaysonia*, *Brachylepis*, *Decalepis*, *Cryptolepis*, and *Cryptostegia*. Hemidesmus, Brachylepis, and Decalepis are all nearly allied genera; Cryptostegia and Cryptolepis are also very nearly allied; while Streptocaulon, Finlaysonia, and Periploca are so much alike that it is now my belief they might be advantageously united.

EXPLANATION OF PLATE 182 or 155 c.

1. Streptocaulon calophyllum. (R. W.)
2. —— tomentosum. (R. W.)
3. —— extensum. (R. W.)
4. Periploca græca. (Linn.)
5. Finlaysonia obovata. (Wall.)
6. Decalepis Hamiltonii. (W. & A.)
7. Brachylepis nervosa. (W. & A.)
8. Cryptolepis Buchanani. (R. B.)
9. Cryptostegia grandiflora. (R. B.)

End of Second Volume.

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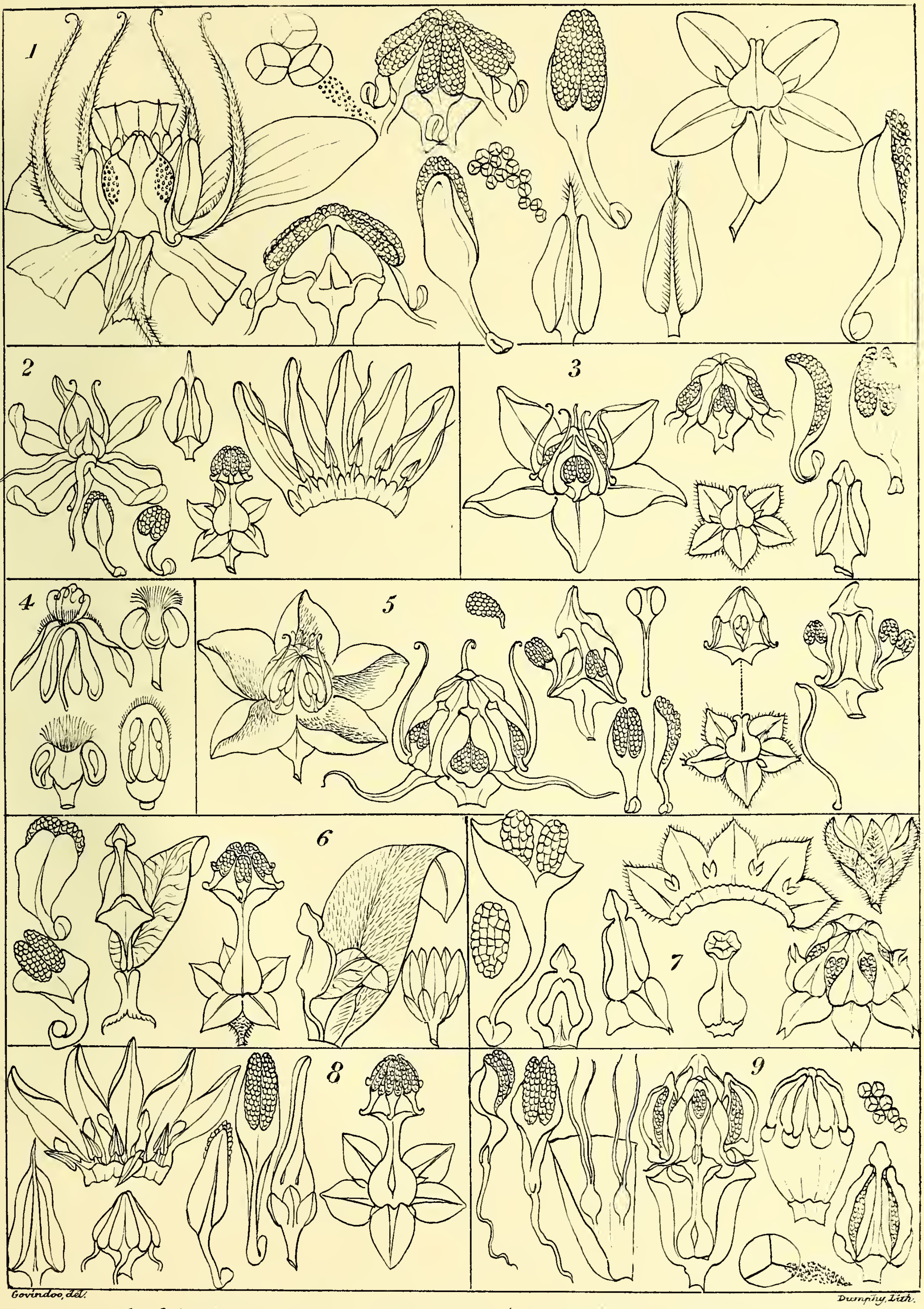

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1 to 3. STREPTOCAULON. 4. PERIPLOCA. 5. FINLAYSONIA. 6. DECALEPIS.
7. BRACHYLEPIS. 8. CRYPTOLEPIS. 9. CRYPTOSTEGIA